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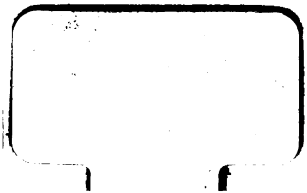
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# THE NEW PEACE

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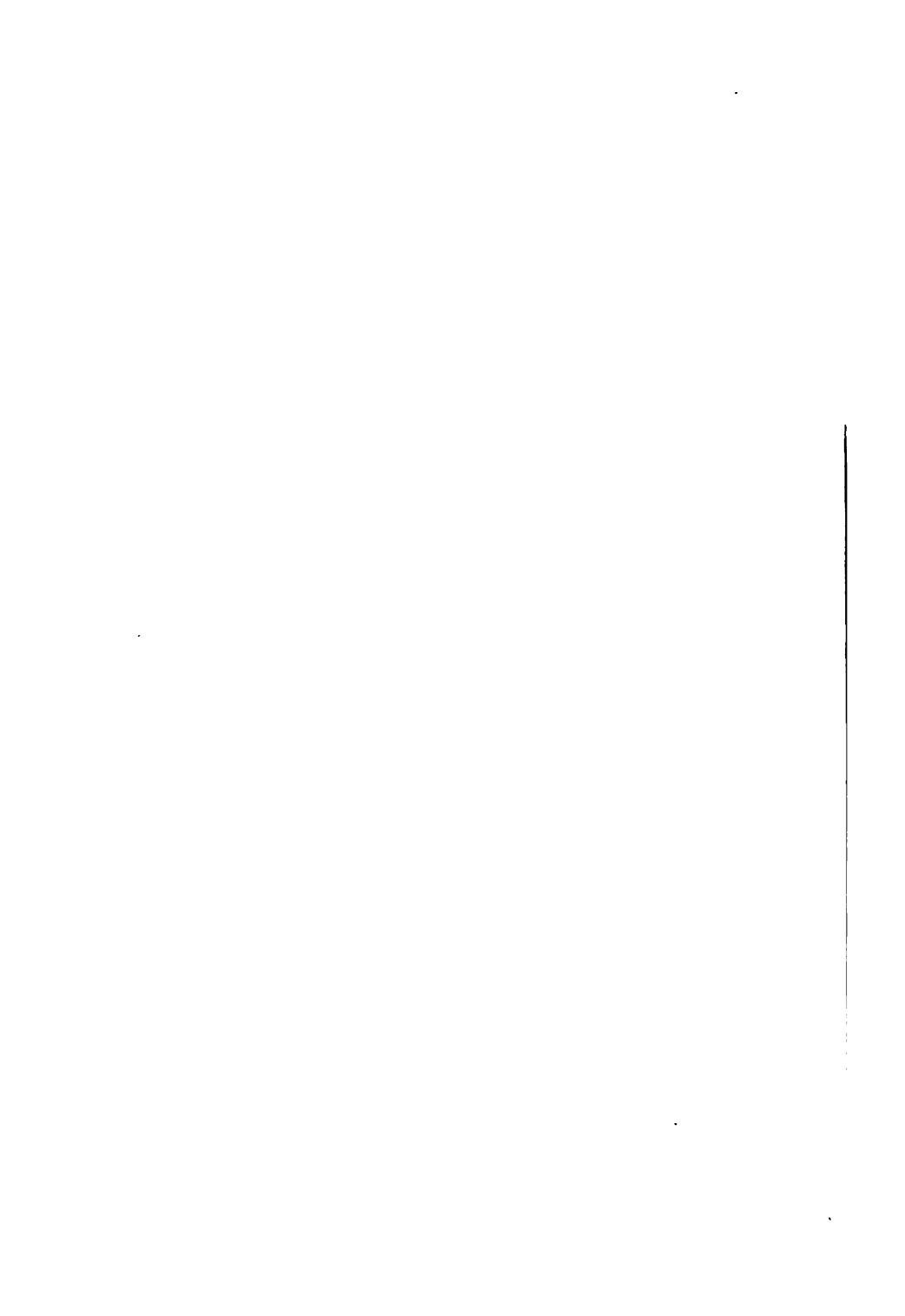
WILLIAM LOUIS POTEAT

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# THE NEW PEACE

*Lectures on Science and  
Religion*

+✓

BY  
WILLIAM LOUIS POTEAT  
M.A., LL.D.

*Peace settles where the intellect is meek.—Wordsworth.*



ARTI et VERITATI

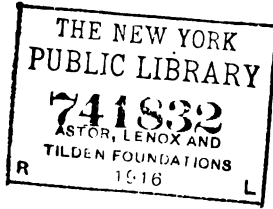
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To  
The Memory of My Father  
JAMES POTEAT  
And My Mother  
JULIA A. McNEILL POTEAT

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★ PUBLISHERS' WEEKLY.



MOY VAN  
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## PREFATORY NOTE

The lectures which are here published were given in May, 1905, on the Brooks Foundation in Hamilton Theological Seminary of Colgate University. In October and November of the same year they were repeated in Crozer Theological Seminary, Newton Theological Institution, Rochester Theological Institution, and the Divinity School of the University of Chicago. Dr. William Newton Clarke, of Hamilton, and others for whose judgment I have the highest respect urged the publication of the lectures, but, excepting extracts which have appeared in two issues of *The South Atlantic Quarterly*, they have lain by me for one reason or another now nearly ten years. They are now presented in their original form. No revision seems to be required by the passing of this period. Certain unimportant time references and illustrations need not be noted in detail because the reader will recognize them as of 1905, not 1915.

My hesitation has been mainly due to the reflection that to many minds the whole discussion will seem out of date. They have already reached

## PREFATORY NOTE

the conclusion to which it leads, and are now interested in the more positive and practical aspects of religion. Any such readers I can hope to serve in only two ways,—by providing a convenient summary of an argument which they may be pleased to recall, and by seeking to increase their number.

My dependence and obligations are but slightly indicated by references here and there. Indeed, I seem to have done little more than bring together the thoughts of other men. So far from making any claim to originality of matter or treatment, I am only mediating the intellectual movement of our revolutionary period in the interest of those who, although close enough to be disturbed by it, have had inadequate opportunities to follow it.

WILLIAM LOUIS POTEAU.

*Wake Forest College,  
February 22, 1915.*

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*Science discloses the method of the world, but not its cause; Religion its cause, but not its method; and there is no conflict between them except when either forgets its ignorance of what the other alone can know.*

—James Martineau.

*He saw two angels who came one from the South and the other from the East. When they came close to him in heaven, the angel from the East clothed in purple and the angel from the South in hyacinth color rushed together like two breaths of wind, and were one. One was an angel of Love and the other was an angel of Wisdom. Swedenborg's guide told him that on earth these two angels had been bound by an inward sympathy and constantly united, though divided by space.*

—Balzac, *Seraphita*.

*The differences of Idealism and Materialism are complementary, not antagonistic; and thought will never be completely fruitful until the one unites with the other. . . . It is an indisputable truth that what we call the material world is only known to us under the forms of the ideal world. . . . The extension of the conceptions and of the methods of physical science to the highest as well as the lowest phenomena of vitality is neither more nor less than a sort of shorthand Idealism; and Descartes' two paths meet at the summit of the mountain, though they set out on opposite sides of it.*

—Huxley, *Descartes' Discourse on Method*.

# THE NEW PEACE

## INTRODUCTION

**M**Y first duty is a personal one. I beg to express to you the high estimation in which I have held this lectureship.<sup>1</sup> The history of culture is everywhere the history of intercourse. The most backward tribes of men, as the inhabitants of the Andaman Islands and of Central Africa, do not know one another and are in the state of chronic hostility, as, on the other hand, the most advanced sections of the race are those in which communication is widest and freest. It must be so in the case of distinct departments of inquiry. Each of them is under its own law, but owes a higher allegiance to the unity of all truth. Specialism is perpetually threatened by the nemesis of isolation, and isolation in the intellectual realm is the mother of strife and has but one eye, and that dim with a cataract. The Brooks foundation recognizes the higher law of fellowship in the kingdom of truth. From time

<sup>1</sup> The Brooks Foundation in Hamilton Theological Seminary.

to time it calls into the school of theology a worker in the school of science, and however indifferent his particular service may be, the total result cannot but be reciprocally beneficial in the highest degree to the two schools of thought. I am not sure that such an example of the hospitality of theology towards science ought not to be emulated oftener by science in openness to informed theological suggestion. As I think we shall see presently, science has not been able to answer all her questions, and on the deepest of them, I half suspect, the hopeful digging must be done over the fence in the theological preserve. My own appointment to service upon this honorable foundation, you will let me say, has been the occasion of the keenest personal gratification. I venture to hope that our thinking together on the great themes which invite us will, at least in some scant measure, promote the aims of the noble man in whose memory we shall be meeting.

#### *The Present Situation*

It will probably be serviceable to pause on the threshold of our discussion in order to examine briefly the present situation of the religion and science question.

And first let me remind you that knowledge is not hereditary, though the capacity for knowl-

edge may be. It is only the receptacle that our ancestry furnishes. We must fill it ourselves. Nor is knowledge a devisable commodity. It is always self-acquired. Experience keeps the only school there is. In the literal sense, but in no other, does the child start life on his father's shoulder. He must begin at the ground. He must pick his own path through the labyrinth. The law may seem severe and the spectacle pathetic, but there is no release. A generation fares no better in this regard than the individual. It does not stand on the shoulders of its predecessor. Except in the mere appurtenances of life, it starts life afresh. It is, indeed, born into its environment, but must conquer its place there. The very language which it will speak it must acquire; the implements of its intellectual and spiritual achievement it must grow. Its own peculiar problems, practical, social, intellectual, it must treat precisely as if no preceding generation ever had a problem. In all its larger and higher interests the so-called lessons of history, by some strange lapse of memory or defect of adaptation, seem not to be available.

Accordingly, it turns out that successive periods in the history of thought, from the earliest to the latest, in spite of the peculiar features which individualize them, present a curious family re-



semblance. Such common traits stand out with striking distinctness in a comparison of the periods properly styled revolutionary — periods when a new view has turned things topsy-turvy, when a new method has been grasped, or a new province added to the intellectual domain. For human nature is very human wherever you come upon it. It responds in much the same way, whatever stimulus is applied. As the optic nerve and visual centre under any excitation, whether luminous or mechanical or electrical, unvaryingly react with the sensation of light in accordance with their specific energy, so human thought, in response to the deep stirring of it by any sort of agency, takes up one predictable itinerary, passing from attitude to attitude unconsciously in the very tracks which it made when it was last stirred to movement. One would suppose antecedently that those who form and guide the thought currents in these revolutionary periods must be familiar with the history of opinion, and in the light of that history, although they might not be able to forestall the repetition of its distressing features, would at least be on guard against oversensitiveness to their influence in view of their recognized transitional character. But it has not in very fact been so — not even in the last revolution, which has had the double advantage of the

largest number of monitory examples and the widest intelligence to apprehend them. So little can we learn from those who have gone this way before us.<sup>2</sup> We must needs have our own experience and, unhelped of the counselling past, work out our own salvation with fear and trembling.

Nevertheless, it will be worth while, at our leisure, to place our epoch alongside its fellows of the former time. They will throw light upon it, and suggest a hopeful issue. It will take the edge off any anxiety which we may feel to-day, if we are in a position to reflect that the present distress is not without precedent, that "it hath been already in the ages which were before us." We shall see that, as heretofore so now, the threatened passing of religion is only another false alarm, and that the terror with which many minds have watched the eclipse of faith as if it were the closing in of night is not wholly devoid of a ludicrous suggestiveness.

A recent student of the transitional eras in the history of human thought has cited four as typical,—the era of the Greek Sophists in the fifth century before Christ, the era of transition from mediæval to modern times, the Illumination era

<sup>2</sup> Ecclesiastes, I:11.

of the eighteenth century, and the present era.<sup>3</sup> There is no time for so much as a bare sketch of the forces in which the first three of these eras took their rise, or of their special features and issue. It must suffice here to point out the constant features which reappear in them all as well as in our own era, which of course is the concern of these lectures. We observe, first, the coming of the new thought like the irruption of an armed band into the peace of a secluded valley. Under the sanction of its convincingness, there follows criticism of the old thought as being incompatible; then disintegration, confusion, and a skeptical despair, spreading beyond the borders of speculation to invade the realm of conduct; then springs up dissatisfaction with the method and results of negation, to be followed shortly with the constructive work of adjustment and reorganization, wherein is gathered up what was vital and precious in the old thought freshened and enriched by the incorporation of the new.

In our own epoch these typical transition stages, which of course are stated here in the logical order, are easily recognizable,—the last of the stages, I venture to say, already realized, as distinctly as the others, in a large section of the serious-minded world. But the interest which

<sup>3</sup> Armstrong, "Transitional Eras in Thought," Chap. II.

this great transition has for us lies also in part in the special features which differentiate it from its predecessors. For example, many streams from the older times pour their floods into ours to give it an unexampled complexity. We are occupied, indeed, with the problems which the Illumination left unsettled, but from a somewhat different point of view. Besides, we have problems of our own which, while their seeds sprouted before, yet reached the acme of development, became acute problems, in our period and distinguish it. But the chief differentia of this transitional era are,—democracy, with popular enlightenment, industrialism, and physical science, each with a wide range of influence upon contemporary life and thought. All these peculiar features must be set on one side, except the last. They are interesting in themselves and important, but are beside the present purpose. Science and the new phase of the religious question which it brought on — these set the limits of our inquiry.

How did science bring on the religious question? What is the genesis of this disastrous controversy between the men of science and the men of religion? *In the first place*, the Reformers who scouted an infallible church set up an infallible book as the ultimate authority on all matters to which it referred. The Bible was assumed

to speak the last word, not only on Hebrew history and religion, but also on the facts of physical nature. Its interpreters opposed the rising scientific view whenever it collided with the Biblical view, as they saw it, and so won for the religion which they represented the odium of antagonism to science. *Secondly*, the current systems of theology, which were formulated and closed before the rise of modern science, contained implications and sometimes explicit statements sharply opposed to assured scientific results. Men of science and theologians themselves practically identified religion with such formal expressions of it; and here again religion appeared to be in conflict with science. *Thirdly*, the fixed habit of unquestioning appeal to authority and to precedent was fostered and perpetuated by the prevailing system of education, and this education was under religious control. When independence spoke, as it did almost solely in the language of science, it spoke against authority entrenched in religious sanctions; and yet again religion and science were at strife. *Lastly*, the religious experience itself presupposes the existence in human nature of a feature which fails to respond to any of the scientific tests, and it postulates another world beyond the sweep of the scientific vision. The basis of religion, it is said,

science does not know and cannot justify; and once more religion and science part company with averted faces.

Now, it takes two to make a quarrel, and in this controversy born of blunders, in this "battle-ground of darkness" where friends have been fighting one another, the responsibility belongs to both the antagonists. Working apart, they misunderstood each other. The theologian had no more training in science than the inhabitants of Jupiter who, according to Swedenborg, do not affect the sciences, calling them shades. The man of science, on his part, preoccupied with the world of sense, lost interest in the supersensuous realm, then forgot it, then denied it. Conflict was inevitable.

Simple and clear as is the origin of the controversy, its present status is most complicated and difficult to describe. The solutions of the problem which have been proposed from time to time, while logically progressive, have not successively supplanted one another so as to leave the last in sole possession of the field. One finds them all side by side in practical vigor in the world of intelligence to-day. There is the doctrine of the "double truth," which holds science and religion to be equally true, though contradictory; they are wholly unrelated. There is

supernaturalism, insisting that dogma cannot contradict reason because it is above reason — peace, you observe, secured under “a treaty of boundaries.” And rationalism, the expression of revolt from supernaturalism, is still criticising the body of traditional beliefs, still assuming religion to be identical with its dogmatic representation. Probably the next thoughtful man you meet will be a mystic who is superior to the pressure of our religious problem because he is at once assured in his inner sense of the higher realities and indifferent to ecclesiastical forms and beliefs. And now and then you will encounter the student of the science of religion, to which, at any rate in his view, is committed the final settlement of the claims of science and religion.

The situation is further complicated by the varying practical attitudes which men have taken towards the question. For many minds it has no interest whatever. Some do not stand where the streams of our intellectual life are flowing. Some who do are wholly absorbed in the products of the mystical fancy, in the theosophies of India, or the new psychologies of the sub-conscious self, and the threat of scientific materialism is too remote to reach them. Others once keenly aware of it have grown weary of its long overdue prophecies and dropped it out of mind. Moreover,

some of the foremost of the students of science also are indifferent; they interpret the quieting down of attack as surrender; they have ceased to criticise the statements of idealism and religion, and, in courteous and respectful estrangement, devote themselves to their task of strengthening the claims of science and widening the range of its authority. On the other hand, those who do feel concern in the religious question have made very unequal progress in the discussion of it. Some stand even now in mortal terror of the newly discovered Darwin and his "bulldog," while others have passed through the evolution struggle and are now engaged in the reconstruction of Christian dogmatics from the evolutionary view-point. Correspondingly, not a few men of science are urging, with a sort of fresh apostolic ardor, that physics and chemistry are the all-sufficient solvents of the mysteries of the universe, that thinking and willing and feeling are only matters of varying molecular stress; but some of their comrades in labor have completed the cycle of scientific thought and gone through the limitations of its method to find that nature is at bottom mental. In one part of the field the battle waxes warm, in another hostilities are suspended under a flag of truce and articles of a formal reconciliation are being drawn up, in yet another



friends of years take counsel of one another and marvel at the tragedy of the early alienation.

The difficulty of dealing with such a situation is obvious. But another difficulty must be added. In the study of the relations of science and religion, we are dealing with tendencies and values, with tone and emphasis and bearing, with implications and general impressions. These value judgments it is more difficult to set forth than a definite body of teaching would be. Sharpness of outline and precision are just the qualities which they lack. The result of the effort to sketch them will be more or less under haze, however much care one may devote to the delineation. Moreover, the play of the personal equation, for which there is large room, may give to the work of one student a color which will not blend kindly with the color of another piece of work in the same field, if, indeed, there be not opportunity for a deeper divergence. We ought to be prepared for both the indistinctness and the difference of treatment, and be on guard against exaggerating the significance of either. They belong to the subject itself, at least to the stage of development which it has now reached. The discussion, as we have seen, is still under way. Precise and authoritative conclusions are yet to be formulated. Besides, material for the argument

may be gathered at well-nigh every point in the whole range of human learning, both philosophical and scientific. So vast a continent no man will ever again master. One may break into its riches here and there and bear off a pebble or two. One may climb a little hill and look about one to wonder and to covet. But to be at home in these wide reaches of plain and upland and cloud-capped mountain,— even Aristotle, “the master of those that know,” or Francis Bacon, or Alexander Humboldt, would lose his way and be driven to seek some one to guide him, however much he might be helped by the cognate relation of the branches of knowledge. A consistent and a definitive treatment of our problem, where so much is involved, is, I fear, many years ahead of us, and must be the work of many minds co-operant each according to its place and outlook.

From the point of view of the present discussion science and religion are not inherently antagonistic. And this absence of antagonism is not the result of their occupation of distinct spheres which are without contact or communication. They are, on the contrary, bound together in the relation of positive friendship. And that union is more intimate than that of the two plantations which came to a neighbor of mine in the division of the ancestral estate. There fell to

him two tracts of land some four hundred yards apart. But the commissioners apportioned to him in addition a narrow strip of land connecting the two tracts, so that he might, as they said, drive his hogs from one to the other without having to cross another man's property. Whose property *could* lie between the tract of science and the tract of religion? There would be nobody to claim it. No; the two regions lie full alongside. They are, rather, continuous, and the line which has divided them is artificial, the creation of a too exclusive specialism. It is like the lines drawn by ignorance and prejudice between sections of one great country, as East and West, North and South. I shall be glad when the memorials of this fictitious boundary retain only an historic interest, like the stones which once marked Mason and Dixon's Line, some of which are now preserved in a Baltimore museum as historical curiosities.

#### *Plan of the Lectures*

As Socrates and Phaedrus lay on the grass under the plane-tree outside the walls of Athens and discussed an oration of Lysias, Socrates remarked, as he began a rival composition of his own on the same theme, "On every subject there is but one mode of beginning for those who would deliberate

well. They must know what the thing is on which they are deliberating, or else of necessity go altogether astray." Let us respect this counsel and seek first of all to establish a definition of science and a definition of religion, and then, "with these to look back upon, proceed to consider" their relations. Accordingly, the subjects of the lectures will be,—“What is Science?” “The Scope of Science” (involving function and relations), “Science in Religion,” and “Religion in Science.”



**LECTURE I**  
**WHAT IS SCIENCE?**

*Let thy studies be free as thy thoughts and contemplations; but fly not upon the wings of imagination; join sense unto reason, and experiment unto speculation, and so give life unto embryon truths, and verities yet in their chaos. . . . The world, which took but six days to make, is like to take six thousand to make out.*

— Sir Thomas Browne, *Christian Morals*, II.v.

*Go, my sons, sell your lands, your houses, your garments and your jewelry; burn up your books. On the other hand, buy yourselves stout shoes, get away to the mountains, search the valleys, the deserts, the shores of the sea, and the deepest recesses of the earth; mark well the distinction between animals, the differences among plants, the various kinds of minerals, the properties and mode of origin of everything that exists. Be not ashamed to learn by heart the astronomy and terrestrial philosophy of the peasantry. Lastly, purchase coals, build furnaces, watch and experiment without wearying. In this way, and no other, will you arrive at a knowledge of things and of their properties.*

— Peter Severinus, *sixteenth century*.

*Danish Professor of Poetry, Meteorology and Medicine. (Cited by Geikie, Founders of Geology).*

## WHAT IS SCIENCE?

**O**UR period is often called the scientific age, and yet in large areas of the public mind of to-day the whole matter of science is enveloped in cloud. Misapprehension of it and suspicion were, perhaps, to be expected when it first intruded itself among the intellectual pursuits at the dawn of the modern era. Roger Bacon and Bungay, who laid the foundations of English science at Oxford, were, not unnaturally, the objects of popular suspicion and bore the odium of prying wizards. The first scientific society of which we have definite record was established in Naples in 1560 under the presidency of Baptista Porta, and bore the name "Academia Secretorum Naturae." It arose out of a meeting of scientific friends in Porta's house, who called themselves with a gay irony *Otiosi*. The name of the Academy was a suspicious one. It suggested magic and the black arts. The suspicion was contagious and spread northward to Rome. The Pope sent for Porta. The Pope made a distinction between the President and his Academy, whether on the ground of the demonstrated cleverness and good intentions of the President standing actually before him,



while the Academy, distant and vague, took on imaginary terrors, I do not know. But the Pope made a distinction: he absolved the President, but dissolved the Academy. The founding of the Royal Society about a hundred years later is one of the landmarks in the progress of science, but Addison and Steele make sport of it.<sup>1</sup>

Happily to-day no one anticipates the dissolution of Italian, English, or American scientific associations by either ecclesiastical or civil authority. The time for that sort of impeachment is wholly passed away. But are the wits who were wont to pasture in the scientific field all dead? Are we quite sure that even in this scientific age there are no survivals of the early ill repute of science when it was fighting its way to respectability? Is the man of science, who wins ideas, altogether on the same footing as the man of business, who wins wealth? Is he not often the victim of pen and pencil caricature? Is he never regarded as a harmless sort of creature throwing himself away after insoluble puzzles or collecting useless facts very much as little children collect in their play-houses bright bits of broken glass and china? "One friend of mine," says Browning in the "Easter-Day,"—

<sup>1</sup> *Tatler*, 221, 236.

One friend of mine wears out his eyes,  
Slighting the stupid joys of sense,  
In patient hope that, ten years hence,  
"Somewhat completer," he may say,  
"My list of *Coleoptera!*"

And, may I ask, why all this ado when a man like Lord Kelvin declares to his associates that science affirms a creative and directive Power? What is the significance of the all but hysterical interest which religious circles take when Wallace, in the name of science, replaces man at the centre of cosmic relations? Is it not that such declarations in favor of religion by men of mark in science are as unexpected as they are comforting? And does not science even yet meet that "troublesome and difficult opponent"—"a blind and immoderate zeal for religion"—which Bacon recognized in every age from the ancient Greeks downward? Does not one hear now and then covert or open detraction of science and men of science on the part of divines, who, in the words of the *Novum Organum*, have mingled with the substance of religion "an undue proportion of the contentious and thorny philosophy of Aristotle"?

If we pass into the realm of letters, we may catch the same note of prejudice and distrust. Here is Mr. John Morley approving the view of Dr. Thomas Arnold: "Rather than have phys-

ical science the principal thing in my son's mind, I would gladly have him think that the sun went round the earth, and that the stars were so many spangles set in the bright blue firmament." A few months ago a writer of distinction, in an English review, remarked contemptuously, "It's all about 'science'—and therefore does not concern me"; and he went on to wonder whether there were many men who shared his feeling, which, he said, often took the form of a dread, almost a terror.

Perhaps the suspicion-tinged mist through which many persons look at science has drifted over the popular mind out of the fields of science itself. Its technical phraseology, sometimes foolishly paraded, is both diverting and unintelligible. In an old Irish tale a bard who had spoken before the King and his warriors is warmly praised, because neither the King nor any other could understand him, "so great was his high, noble, beautiful obscurity." The gift of sane and clear exposition is no more common on the scientific platform than on the theological. Besides, certain men, invoking the certitude of physical science, have been rudely inconsiderate of the religious sentiment, which, on its part, instead of going to pieces under the violence of the attack, merely withdrew within itself, reflecting what a dread-

ful thing this science must be! All this may be admitted, but whatever extenuation of this popular attitude may have been supplied by the eccentricity, the oracular airs, the cloistral seclusion, or the materialism of individual men of science, it is in reality without foundation. To see that it is so, we have only to lift our thought from men to their work, and from the details of observation and experiment to the general principles which they have yielded. Accordingly, let us address ourselves to the search for the definition of science. If we can find it, it may protect us against the contagion of the popular feeling to which I have referred, and also against certain errors of popular thinking. For many droll and extravagant notions about science are still current even among those who have the reputation of general intelligence. People still experience Alexander Pope's difficulty of "holding the cel of science by the tail." The subject-matter of science is thought to lie apart in a sort of mystical world. The method of science is conceived of as a sort of one-eyed hunting in obscure corners and dragging out into the light curious little odds and ends which would perhaps have been as well left in the darkness. The results of science excite a distant and dubious wonder not very unlike that awakened by legerdemain. The scientific investigator him-

self is a modern version of the magician Doctor Faustus, who went about with the devil as a companion in the shape of a dog, and who, according to an old Leipzig chronicle, was able on occasion to ride out of a cellar on a bewitched barrel of wine.

On the contrary, as I need not remind you, science demands of her votaries no mystical or magic powers. Her achievements have been made neither by accident, nor by a series of conjuring tricks, nor yet with the co-operation of evil spirits. The noble structure which she has reared in this modern day is the very shelter and dwelling of our life, and it is time all men recognized her and felt at home in her gracious presence. For, I protest, seen near at hand, she is all kindness and simplicity. And they will so recognize her as soon as the demand of science for a place in every stage of the educational process is made good.

#### *Definition*

Of course, science is knowledge, but it is not true that every form of knowledge is science. Here is art, for example, in the industrial and in the æsthetic sense. Art rests on a foundation of knowledge, but its aim is not truth, but utility or beauty. Knowledge in science is the end, in art only the means to an end. Accordingly, the

knowledge with which art is concerned need be no fuller and no more exact than suffices for the matter in hand, whereas science is content with nothing short of the whole truth. Again, science is not quite synonymous with philosophy, although truth is the aim of both. In the seventeenth and eighteenth centuries philosophy was often used as the equivalent of what we now mean by science, and even in our own time the science of physics has been called natural philosophy. But present usage restricts the term philosophy to metaphysics, which a French historian, I think profanely, defined as the art of confounding oneself methodically. Science discovers the orderly sequence of events in nature; philosophy asks why this sequence rather than another? Why any sequence? Science looks abroad and collates; philosophy looks within and thinks. Science experiments, testing its theory by the course of events under artificial and controllable conditions; philosophy reflects, testing its theory by seeking its place in a logical system. And yet science is not all observing and registering. Its method demands the use of the rational powers, and abstract conceptions are an important part of the equipment, as they are the aim, of its investigation. Science readily runs to philosophy. Set here in the midst of mystery, we are smitten with an irresistible

curiosity and must have an explanation. The search for it begins early, as early in fact as three years of age. The onset of "the questioning mania" is signalized by the question "What?" "How?" treads on the heels of "What?" and "Why?" on the heels of "How?" A metaphysician of three summers stated this problem: "If I had gone up stairs, could God make it that I hadn't?" A practical American philosopher of eight asked, "Why don't God kill the devil, and then there would be no more wickedness in the world?" And another, "If God wanted me to be good, and I wouldn't, which would win?" This truth-hunger is one of the badges of our nobility. It grows upon its proper food, which, like Dante's bread of angels, sustains but never sates; so that, diversion and preoccupation apart, it subsides only in the general decay of old age. What wonder, then, that the men on the advance line of scientific inquiry drop so easily into philosophy, passing unconsciously from the cognitive process and the investigation of phenomenal reality over into speculation about the ultimate reality, which is the special note of philosophy.

There is yet another body of knowledge with which science is hardly to be identified. I refer to theology. Professor Briggs has lately defined theology, in its comprehensive and proper use, as

the study of God and of all things in their relations to Him. And he insists that theology is and must ever be the queen of studies, for all other studies have to do with particular provinces of the realm of truth, whereas theology covers the entire realm.<sup>2</sup> Now, science does not directly and explicitly make God the subject of investigation, but the "all things" which Professor Briggs stakes out here as the claim of theology are exactly the ground where science is busying itself. Is science a squatter on the theological domain? If their spheres are so nearly coterminous, wherein lies the difference between theology and science? There is, first, let me say, the difference of emphasis. Theology is concerned with things not on their own account, but only because of their relation to God. Science is concerned with things for their own sake, and only thinks of their relation to God when, rising into philosophy, it seeks their ultimate explanation. There is, secondly, the difference of the means of knowledge which they employ,—reason and the five senses in science, reason and the spiritual sense in theology. Nevertheless, from one point of view they appear to coincide. Theology is not religion, as science is not nature. The religious experience is one thing; the explanation of it — theology in the re-

<sup>2</sup> *American Journ. of Theology*, July, 1904.



stricted sense — is another. But the religious experience is a fact of nature, and as such it is clearly open to scientific investigation. When, therefore, science deals with this section of the world of nature, it coalesces with theology, the two disciplines having the same relation to religion.

The modicum of knowledge which is mixed with varying proportions of error or fancy in numerous nostrums, fads, and cults afloat to-day on the stream of printer's ink, must, like the crane found among the farmer's geese, take the consequence of its unfortunate alliance. It need not detain us beyond this passing reference. The well-informed recognize the combination as pseudo-science, for all its careful conning of scientific phrases and its specious offerings upon the altar of science.

A final limitation of the word knowledge in our definition of science as knowledge, must be made. And by this time you are doubtless assured of the truth of Rousseau's paradox, that definitions might be good, if words were not used in making them. The fund of what may be called common knowledge is large and of the highest importance. It suffices for the practical conduct of life amidst the intricate relations of the external world. Moreover, the sphere, the aim, and the method of common knowledge are essentially the

same as those of scientific knowledge. And yet it is not quite the same as scientific knowledge. To rise to that level it requires to add two qualities,—precision and co-ordination. We conclude, therefore, with Herbert Spencer, that science is “simply a higher development of common knowledge,” that is to say, common knowledge made precise and full and systematic. Let me illustrate. The world in which we live is thronged with animals of many different kinds. That fact is an item of common knowledge. But the demands of scientific knowledge are not met by a statement so indefinite. It requires the exact number of the different kinds of animals, together with the grouping of them according to their similarities and dissimilarities. And so all known forms are described in detail, stationed in a system, and catalogued. When a new one is discovered, whether a microscopic dweller in the slime of a stagnant pool or a giraffe in central Africa, the trumpets of the science journals are blown, and in full view of the scientific world the new-found thing is described and christened amid appropriate ceremonies and congratulations of the now rare and fortunate discoverer. In the hands of the man of science, the average man’s statement, many animals of many kinds, is expanded into Zoology. Take another illustration. A little

girl asked, "How do my thoughts get from my brain to my mouth, and how does my spirit make my legs walk?" Now, ordinary knowledge gets but a little way beyond the simple facts which the child wished explained. But science answers the question — not completely, it must be owned — with Histology, Physiology, and Psychology.

### *The Scientific Method*

So much has been said about the scientific method, there is no wonder that it is believed to be unique and magical and one of the inventions of the century which applied it with such brilliant results. In reality, neither the nineteenth nor the eighteenth century can take the credit of inventing this fruitful method. Nor yet did it originate in the Renaissance, as some suppose. Descartes' "Discourse on Method," important as it is in the history of modern thinking, did not show for the first time the value of deduction and induction as means of knowledge. And we may question the legitimacy of the title of Francis Bacon's great work. The inductive method which it elaborated was really not a "*new* instrument," and his influence upon scientific progress has been much exaggerated. Professor Huxley is doubtless correct when he says that men like Galileo and Harvey and Newton would have done their work just as

well if neither Bacon nor Descartes had ever propounded their views respecting the method of scientific investigation. Certainly Aristotle, who antedated them nearly two millenniums, was in no wise indebted to their expositions, and his work, especially in the observational sciences, in spite of error and fancies here and there, clearly bears the distinctive mark of the scientific method. And Archimedes is the originator of the science of Mechanics. Even beyond Aristotle and Archimedes it may be traced in the Greek philosophers of the fifth and sixth centuries B.C., who displaced the current theological view with the rational view of natural phenomena. We may go still farther and say that the outlines of modern science were rudely sketched by primitive man when he brought his reason face to face with nature. The animal lore out of which totemism springs is a primitive zoology; and when the Lapp transfers the domestic relations of father, mother, and child to different kinds of stones, he is merely classifying them much as a modern geologist would do in more prosaic terms.

In reality the method of science is only the method of common sense applied with care. It is the method which the man of business habitually uses in the humblest matters with more or less carelessness. The man of science is only more

patient, more scrupulous, more exact. An illiterate but strong-minded old woman of the North Carolina mountains once gave me a graphic description of a trip which she made in her girlhood down to Fayetteville with her father, who was "wagoning" to that emporium of the old days. She told how the sand of that low country cut off her stockings at the level of her shoe-tops, and how, as she stooped to examine the wheels of the first railway train she ever saw, some one said, "That thing will cut your head off!" whereupon she fled away so fast and so far that her father, as she said, "wouldn't never 'a found me, ef it hadn't 'a been for the prints of the nailheads in my shoe bottoms!" The mental process by which that mountain wagoner found his frightened child was identical with that by which Cuvier, Hugh Miller, and Marsh have recovered the lost life of the ancient world from footprints and fragments of bone. The universal method of all knowledge of material things is, in brief, observation, inference, verification. I may illustrate it by a comparatively recent research upon the cause of a curious and fatal disorder of central Africa. It is known as "sleeping sickness" from its chief symptom. In the district of Uganda alone it killed 100,000 of the population in two years. Now, the learned author of the "Anatomy of

Melancholy," not less complacently than the native medicine-men, would most probably have referred the malady to the devil operating through "such as command him in show at least, as conjurers and magicians, or such as are commanded, as witches." Not so Col. David Bruce, who spent some five months in Uganda in 1903. Eight years before he had shown the tsetze-fly disease of South Africa to be due to the presence in the blood of horses and cattle of an animal parasite, *Trypanosoma*, carried by the bite of the tsetze-fly. On his arrival in Uganda he was told that this parasite had been seen in the cerebro-spinal fluid of a certain victim of the sleeping sickness. This *observation* he confirmed and extended. He found the parasite in the blood of 28 per cent. of the population of the infected region and in the cerebro-spinal fluid of every victim of the disease. It was absent, moreover, from this fluid in every case not affected by the disease. These observations prompted an *inference*, namely, that this parasite is the cause of sleeping sickness after it passes from the blood into the cerebro-spinal fluid. His observations upon the closely related parasite in tsetze-fly disease in 1895 naturally suggested the added inference that the parasite is transported from patient to patient by the tsetze-fly. The next step in the research was

to *verify* the inference. In the first place, he discovered a species of this fly, and found that the range of its distribution corresponded precisely with the distribution of the disease and where the fly did not occur the disease did not occur. In the second place, after finding a certain species of monkey to be susceptible to the disease, he caused the flies which had bitten infected negroes to bite monkeys, which invariably died with the characteristic symptoms of sleeping sickness and showed the parasite in the cerebro-spinal fluid. And so the inference which observation suggested was verified by experiment, and the real cause of the disease was discovered.

### *Results*

If, now, the method of science is everywhere one and invariable, why, it may be asked, was it so comparatively barren, say, in the sixteenth century, and so exuberantly fruitful in the nineteenth? To present the contrast in concrete form, what is the difference between the work of Paracelsus in physiological chemistry and that of Claude Bernard? The difference lay in the relative emphasis of the several factors of the scientific method in the two cases. Inference and hypothesis are essential steps in an investigation, but they are steps only — steps between observation and ex-

periment. In Paracelsus hypothesis was supreme, in Bernard the test of experiment. And the period covered by Bernard's activity in physiological research coincides roughly with that of the most marked and rapid scientific progress which history has to show. If, as has been lately suggested, the scientific credit of an age is to be determined by dividing the mean truthfulness of its work by its opportunities of reaching the truth, the Victorian age does not, perhaps, so far outrank its predecessors. But when we recall the fact that Victorian science itself largely created the means and the opportunities of its advancement, it distances Greeks, Arabs, and the scholars of the seventeenth and eighteenth centuries not only in the totality of its permanent acquisitions, but also in the scientific credit which is its due. In fact, we seem to be justified in setting this brief period of, say, seventy-five years over against all preceding periods combined. The outburst of intellectual energy which distinguished the fourth decade of the last century, fortunately for science, was not attracted by the cold beauties of a revived classicalism, nor yet by the flippant and negative philosophizing of the eighteenth century. It overflowed the limiting traditions of its origin and cut new channels for itself. It seems to have divined that Nature in the large sense is the test of all things. With a



charmed surprise it discovered that the natural is the true and the beautiful as well, for the beautiful is only the splendor of the true, as Plato said; and for both truth and beauty it made its appeal directly to Nature. It set no boundaries to its exploring zeal. It pursued the truth of which it was enamored into every nook of the expanding universe, and did not hesitate at the threshold of that larger universe, the mind of man. When Mungo Park asked the Arabs what became of the sun at nightfall, they replied that the question was beyond human investigation. For this alert nineteenth century intelligence, which had found its mission and its method, no phenomenon was beyond investigation, no tradition was unchallenged. The sense of mystery attracted it like the impalpable drawings of a hidden magnet. A mystery, said Sir William Crookes, is a thing to be solved.

The record of discovery which followed is unmatched in all history since the first *naïve* questioning of Nature in the childhood of the race. It includes the molecular constitution of matter, the conservation of energy, the cell structure of animals and plants, embryology, the establishment of the doctrine of evolution, spectrum analysis and its application to celestial physics, the antiquity of man and the earth, the application of electricity to communication, lighting, machinery, therapeu-

tics, and chemical research, the railway and steamship, photography and the phonograph, anæsthetics, antiseptic surgery, the germ theory of disease and sanitation, the Roentgen-rays, the electrical atom, electrical waves, and radioactivity.

It will be seen that, with the exception of gravitation and the bare beginnings of physics, astronomy, chemistry, and the biological sciences, these generalizations embrace practically the sum total of our present knowledge of Nature. They are inductions from innumerable observations and verifications. They register and reward years of toil and waiting on the part of an army of self-devoted and widely scattered workers. In all its struggle upward out of savagery humanity presents no finer spectacle than in scaling the summits of nineteenth century science. Every fact won, it held to be a great fact. It saw in every discovery both acquisition and opportunity, and in spite of the taunts of the trivial and the odium of the serious, undaunted in the presence of impossibilities, baffled and wounded, but still ardent and courageous, sustained by faith in the intelligibility of the universe, it pressed persistently up to where its goal of Truth gleamed on the heights. The ignorant or the malicious detractor may cry "depravity and materialism!" till the stars die out of the sky, and to the end this brilliant page of its

history will protest in every line of it that human nature is not all mud, so long as such consecration to a lofty ideal remains possible to it.

It was inevitable that an expansion of natural knowledge so great and, I was about to say, so sudden, should give a species of electric shock to human life, thrilling it from its central deeps out to its thinnest fringes. It was revolutionary. It refashioned the external modes of life and made imperative the revision and reorganization of existing opinions. It put a new expression in the face of Nature and our entire physical and rational life now wears a new aspect and complexion.

**LECTURE II**  
**THE SCOPE OF SCIENCE**

*The experimental sciences had investigated the connection of phenomena; they showed how many and what kind of links constitute the chain of events which connects any cause with its final effect; but what it is that holds together any two contiguous links escaped them; they told neither what things are in themselves, nor in what consists that action between them by which alone the condition of one can become the cause of a change in the condition of another.*

— Lotze, *Microcosmus*, II, 346.

*The function of physical science is seen to be much more modest than was at one time supposed. We no longer hope by levers and screws to pluck out the heart of the mystery of the universe. . . . We have given up the notion of causation except as a convenient phrase; what were once called laws of Nature are now simply rules by which we can tell more or less accurately what will be the consequence of a given state of things.*

— Professor Horace Lamb.

*Presidential Address before the Section of Mathematics and Physics of British Association for the Advancement of Science, 1904. Nature, Aug. 18, 1904.*

## THE SCOPE OF SCIENCE

**A**LLUSION has been made to the view that science and religion occupy distinct and unrelated spheres and cannot, therefore, collide. Honorable names are associated with it, and up to the present time no conception has been quite as serviceable in quieting the fears with which religious minds have watched the steady progress of science. Dr. Martineau among philosophers employed it with great eloquence, and George Romanes among scientists consoled his troubled spirit in his last hours with the independent and authoritative witness of the moral faculties.

Is this the true view? Can we be permanently content with marking off sharply from each other these two spheres of superlative human interest? Will the formal boundary established between these provinces remain inviolable, and, while it prevents conflict, prevent also the reciprocity of friendly influence? When the German bride of the French prince, in her progress to Paris, reached the historic boundary of the Rhine, she entered a pavilion on an island in the middle of the stream and exchanged all her German attire for an outfit brought from Paris. Are there not

signs that something like this is happening where the religious frontier meets the scientific? — the maintenance of separateness with all the “stiff buckram” of official ceremonial, and at the same time the passing to and fro of the most precious commerce of the realms?

This question of spheres is an important one, and in this lecture we shall seek to settle it so far as the scope and function of science are involved. Indeed, our definition of science is incomplete without such a discussion.

In September, 1904, there met in St. Louis the International Congress of Arts and Science. Leading scientists of many nationalities participated. The central purpose of the Congress was the unification of knowledge. The general principles which underlie and connect all the sciences were set forth, together with their historical development and present problems. The classification of the sciences adopted by the Congress is serviceable for our present purpose. Seven great divisions are recognized: *Normative Science*, including philosophy and mathematics; *Historical Science*, including political, linguistic, and religious history; *Physical Science*, with the departments of physics, chemistry, astronomy, sciences of the earth, biology, and anthropology; *Mental Science*, of which sociology is a department; the *Utilitarian*

*Sciences*, as medicine and technology; with two final divisions,— *Social Regulations* and *Social Culture*.

Such a scheme represents the scope of science as it is conceived to-day by those who have right to speak in its name. If not side by side, yet within that scope lie subjects so diverse as crystals and metaphysics, anatomy and psychology, ether and ethics, politics and religion, electrical engineering and ghosts. There may have been more things in heaven and earth than Horatio's philosophy dreamt of in the state of Denmark seven hundred years ago. But in the presence of such an array as this, one may question the truth of the thoughtful prince's remark when it is applied to the present time. For wherever there is an object to be described or an event to be recorded — whether a world flaming in the stellar depths, or an electron scintillating in a vacuum tube; the migration of a sun system or of a flock of snow-birds, under an imperious call from afar — a vibration shooting along the old earth's granite ribs or a tense thread of nerve; the heaving of the wave to meet the moon, a cave plant's struggle for the light, or a soul's passion to lie "breast to breast with God" — wherever a fact waits for inquiry, wherever the search for truth is possible, there lies the sphere of science, not its sphere of influence merely, but its



own proper territory, the field of its labor.

It is easy to see that a line runs through the midst of these varied facts, separating them into two classes,— things and thoughts, outside facts and inside facts. Now, it must be remembered that our classifications are simply intellectual labor-saving devices and that every now and then they will not work. Nature is not over-careful to conform to our mode of conceiving her, and sometimes advances a phase of her manifold activity or a product of her boundless fertility to throw our systems into confusion. These things and thoughts, deeply divergent as they appear to be, might, if we went deeper still, be found to blend in a common substratum, as coral islands join hands beneath the sea. But in any case, it will be convenient to think of them now apart from each other.

1. *Outside Facts.* The objects and activities of the physical universe inorganic and organic supply the material of scientific inquiry as it is usually distinguished from other forms of inquiry. The theologian and the philosopher may delve in other regions for the truth they seek, but the man of science, while not confined, as we shall see, to the external world of the senses, has yet occupied himself mainly with it; so much so that, in the view of many, he is in danger of losing credit in proportion

to the range he allows himself beyond these confines. If, on the other hand, he keep discreetly within sensuous bounds, he is able, only with the greatest difficulty, to avoid the opprobrium of low-browed materialism. In the study of material objects the scientist cannot be content with the knowledge of form and structure, but must push his inquiry into questions of origin and relations, the energies which play upon them and issue from them. Nor does he pause when these questions are answered. He must know cause and essence so far as they are accessible to human faculties. For accumulated facts, as we have seen, are not science. They require rational treatment. The body of scientific truth is, accordingly, the achievement of observation and reason in co-operation. As one stands before the enlarging mass of facts which are yet unrelated in a generalized interpretation, one feels inclined to ask whether it is worth while to add with infinite labor sand grain to sand grain for the simple purpose of having a big heap of sand rather than a little one. Unfortunately, the endowment of research concerns primarily the collection of facts, whereas at this stage we appear to be in as much need of adequate interpretation. Facts? Yes, by the mile of printed page. But what do they mean? An earlier period sat within and reasoned how things must be, instead

of going abroad to see how things were. The question of how many teeth a horse had was hotly debated through many writings and was on the point of leading to bloodshed, when one of the writers bethought him at last to look into a horse's mouth and count. Learned scientists in the University of Pisa refused to accept Galileo's discovery of the moons of Jupiter, on the ground that it was impossible that Jupiter should have moons. They argued from the analogy of the seven windows set in the microcosm of the head and from "many other phenomena of nature, such as the seven metals, etc., that the number of the planets is necessarily seven." There was no need to look through Galileo's telescope, and they stoutly refused to do it.

We have swung to the opposite extreme. In the enthusiasm of our consciously recognized method, observers multiply, but interpreters, who combine higher capacities, are the gifts of Providence only at rare intervals. The Newtons, the Lyells, the Helmholtzes, the Darwins, are worth waiting for. Perhaps they come as fast as they are needed. When the new generalization does come to be made, it will rest on a wider induction and prove to be all the more luminous and authoritative.

But, it may be asked, is not the external world

itself a projection of the internal world? and is not science, by holding itself so closely to the physical order, after all missing the pathway to reality? Possibly the Berkeleyan idealist is correct when he insists that "things" are only "definite assemblages of states of consciousness," and accordingly do not exist apart from the perceiving mind. The world, in that case, disappears in mist; becomes, as Fichte said, only a dream of dreams. It may be replied that these are conceptions of closet philosophers and only need the touch of experimental science to evaporate, like their world of matter, into thin air. But there are not wanting scientists of high repute who maintain a closely allied position. The President of the American Association for the Advancement of Science three years ago declared that we do not have and never have had any evidence whatever that matter exists. And Professor Karl Pearson expresses practically the same view. "The mind," he says, "is absolutely confined within the walls of its nerve exchange; beyond the walls of sense-impression it can logically infer nothing." "Immediate sense-impressions," he says further, "form permanent impressions in the brain, which psychically correspond to memory. The union of immediate sense-impressions with associated stored impressions leads to the formation of 'constructs' which

we project 'outside ourselves' and term phenomena. The real world for us lies in such constructs and not in shadowy things-in-themselves."<sup>1</sup>

It so chanced that the evening after the reading of this discussion I took, after the sun was down, a little jaunt across the railroad, through the pines and along the lighted border of the wood as far as the brook. I was turning over in my mind Pearson's statement that we have no right to infer order and reason and benevolence and beauty outside ourselves, that "chaos is all that science can assert of the supersensuous." Just as I reached the little brook and its unbroken tangle of alders and blackberries and vines, a startled cardinal with a rapid *twitch, twitch, twitch*, flew out of a sheltering grape arbor at my side. I thought how delightful a spot he had chosen for sleep. The water slipping over the little ford made only enough of its soft murmuring among the pebbles to wake him if it should suddenly cease. The flute-like trills of a hundred white tree-crickets, clear and full but caressing, would surely allay any fever of excitement which the day had left in his brain. And over-head the moon with one bright attendant had already cleared the shoulder of the pine wood on the slope to the southeastward, and was ready in a heaven all

<sup>1</sup> Grammar of Science, 75, 107, 108.

sweet and fair to watch his sleep the whole night through. When I turned homeward to the west the sky line burned red through a bit of pine crowning the hill, and higher up a radiant saffron haze all but quenched the steady flame of Venus for a minute or two, then followed its lord over the rim of the world. Farther on a lamp beamed upon me through the door of a humble home and just beyond it a locomotive, with brutal self-assertiveness, broke in upon Nature's passive serenity.

Unwittingly I had brought my scientist's problem out into the midst of an epitome of universal nature. The engine was the symbol of toiling and moiling man and his battle for bread and pelf; the cottage spoke to me of love and consecration; and the frightened bird, the care-free insect, the glooming wood beneath, and the glowing planets on high were witnesses of all Nature's realms and provinces. I said, Can it be that the beauty which I admire here is all my own, being purely conceptual? that the order and adaptation and purpose which thrill in my mind in this particular external situation are not my discoveries, but my creations? Can it be that the sense-impressions that rouse in me the feeling of rationality and harmony spring themselves out of blank chaos? And this conceiving mind which works such mar-

vels out of chaotic materials — whence came it? How comes it to be just here now, not only ordered but ordering? Is mind the offspring of mindless chaos?

Allow that matter is not reality, but only phenomenon. It must nevertheless express and symbolize reality one or more removes back of it. This ground reality which we are never able to see as it is, whose robes flowing through the world we glimpse here and there, whose shadow is the stage of our life drama and the field of the scientific quest, this ground reality may be inscrutable in itself, inaccessible to our present exploration outfit; but it does not follow that it is non-existent. There are, in fact, three independent witnesses to the reality of the external world, — one theoretical and two practical. Theoretically considered "the reality of the external world is the necessary presupposition of the logical sequence of the phenomena of consciousness." One practical proof is presented in the external results of our inward willing. Sense-perceptions answer accurately to the inner effort. For example, in the case of voluntary muscular movement, the ego is conscious of being resisted by something distinct from itself, as Dr. Johnson is said to have refuted the idealism of Berkeley by kicking a stone; or in the case of pain we

know that our will is obstructed by a cause which does not lie in it and which must be, therefore, an activity outside ourselves. Another practical proof of the reality of the external world we have in the observed relations of objects to one another. The moon, for example, influences the tides on the earth. Clearly this influence was in operation before any human consciousness had arrived to make such a "projection" of an inward state. Uranus and Neptune did not *begin* to disturb one another in 1846 when Neptune was discovered.

2. *Inside Facts.* To a few men of science like Ernst Haeckel, the world of things is the only real world; there is nothing in the universe except "space-filling matter and active energy." The manifestations of mental life are reducible to terms of nervous energy and are as much bound up with neuroplasm as the mechanical energy of muscle is with the contractile myaloplasm. In other words, mind is the physiological function of the cells in certain parts of the cerebral cortex, in the same sense as contractility is the physiological function of muscle cells. And yet when Haeckel makes sensation, like movement, an attribute of all matter for the purposes of his monistic theory, does he not tacitly admit in another form the reality of the thought world, which, on



the dualistic theory, is only differently related to the world of objects? In fact, he says explicitly that the strenuous opposition between modern monism and traditional dualism may be toned down — may, indeed, be converted into a friendly harmony. In recalling this language of his *Riddle of the Universe* of 1899, he assures us in 1905 (*The Wonders of Life*) that “this conciliatory disposition has grown stronger and stronger” in the interval. Accordingly, one is not surprised to read a few sentences farther on, “Our realist philosophy of life teaches us that our ideals are rooted deep in human nature.”

Now, it is to be observed that on any theory the inside world is no whit less real than the outside world. Suppose with Haeckel that the trinity of substance is composed of matter, force, and sensation with its elaboration in the phenomena of consciousness; or suppose with Ernst Mach that “matter” is only a mental symbol for a complex of sensuous elements, the universe consisting only of force and consciousness; or again suppose with Ostwald that consciousness is but a special case of force or energy, which alone constitutes the universe; — in any case, the world of thought and feeling is still a world of fact. As such it lies open to scientific exploration.

The method of science is the same here as in

the outside world. For the method of introspection which is so important here, is, after all, only observation with its eyes turned inward. But the conceptual symbols devised to aid us in the study of physics or chemistry, such as atoms, molecules, and the conservation of energy, are likely to prove inapplicable when we pass to a different order of facts. We have need to remember always, as Mach has pointed out,<sup>2</sup> that these devices by which we seek to reproduce facts in thought are, like the symbols of algebra, capable of yielding only what we put into them. They do not exist except in our minds, and have no value or validity save as short-hand representations in thought of the world of experience. A new province of that world will require new symbols. In the sphere of mental life the atomic theory is out of place and can render no service. Nobody expects to "find the secret of genius or the moral law in the bottom of a retort." No Newton or Leibnitz has yet arisen to give algebraic expression to variations in the states of consciousness. The deep affinity which draws two spirits together does not vary inversely as the square of the distance. The world of emotion and idea remains incapable of mathematical analysis, in spite of the hopes which were raised

<sup>2</sup> Analysis of the Sensations, *passim*.

fifty years ago by the work of Weber and Fechner on sensation. Too little is as yet known in this high region for the fashioning of conceptual keys to unlock its problems. It is frankly confessed that its central problem can be approached at present only by way of theories known to be inadequate and unsubstantiated by facts.

And yet science is pushing out into this world of mystery. It has taken up its task. Its confession of ignorance is no longer held to justify the preemptive claim of metaphysics and theology to all the rights and charters of exploration. For 1,300 years the sacred capital of Tibet was guarded against invasion by a system of espionage and penalties, so that in that period not more than twenty foreigners had passed within its walls. But in August last the British flag was unfurled in Lhasa, and when the treaty had been signed, the lime-light photograph taken in the council chamber of the Potala dispelled the last mystery of the Asian continent. With the sense of responsibility and under the splendid fascination of an extremely difficult task, science has struck tent at the Indian border and is off for the roof of the world.

We conclude, therefore, with Professor Pearson, that the legitimate field of science embraces all the mental and physical facts of the universe.

*The Function of Science*

We have now to inquire into the work which science does in its proper field. What is its business? its aim? What do these delving men of science seek? What is precisely the task which they propose to themselves?

From his first awaking to self-consciousness man has been infected and his life has been moulded by an insatiable curiosity in the presence of the mysteries around him and within him. The universe of air and sky, the multitudinous sea, the teeming earth, the secret stirrings of his own nature, have been a lure and a challenge to his capacity, and according to the level to which he had risen, he answered with animism and taboo, with myth and magic and theology. These answers, as has been already remarked, are all forms of primitive science into the structure of which religion enters as an inextricable constituent. Even after these thousands of years we are still under Nature's spell, and

Those stark wastes that whiten endlessly  
In ghastly solitude about the pole,

awe and fascinate us as the herds of cloud cattle pasturing in the plains of heaven, or the marvel of the dawn, awed and fascinated our forebears in their early Aryan home. We cannot be content

while under our feet miles within the earth secrets slumber or now and then stir to send a defiant tremor through its frame; we must needs sink a well into the midst of them, and if it go twelve miles deep and cost two millions of treasure according to a recent proposal, so much the better. We shall learn more than if we laid open the secret of either pole. And this wondrous personality, which is always with us like a veiled presence, whispers tauntingly behind its disguise, "closer am I than all, and even yet unknown"; and volume succeeds volume into the thousands, some of observation, others of reflection, all striving to lift a corner or peer through a mesh of the veil which hides us from ourselves.

The will to know is a human characteristic, and Dante's explanation is as good as any we might offer to-day: "The reason whereof may be that each thing, impelled by its own natural foresight, inclines to its own perfection; wherefore, inasmuch as knowledge is the distinguishing perfection of our soul, wherein consists our distinguishing blessedness, all of us are naturally subject to the longing for it." This inherent love of knowledge drives us out upon our quest, this is the fountain out of which the stream of science flows. But in what does knowledge consist? When may this natural craving be said to be met?

In the words of the great philosopher-physicist of Vienna, "Every practical and intellectual need is satisfied the moment our thoughts have acquired the power to represent the facts of the senses completely. Our knowledge of a natural phenomenon is as complete as possible when our thoughts so marshal before the eye of the mind all the relevant sense-given facts of the case that they may be regarded almost as a substitute for these facts, and the facts appear to us as old familiar figures, having no power to occasion surprise."<sup>3</sup> Such a mental picturing of the facts of nature is the end and aim of science. This is all we can legitimately mean by explanation, as indeed the etymology of the term suggests. It means to make thoroughly plain, i. e., flat, involving the removal of obstructions and irregularities; consequently, to make evident, visible to the mental eye. Accordingly, a natural phenomenon is explained when we are able to reproduce in thought its place in the stream of events, its antecedents and its consequents, and feel no need of further inquiry. The phenomenon of old age, for example, is explained in the scientific sense, as soon as we can picture to ourselves the following sequence of histological events: the growing flaccidity and vacuolation of nerve, mus-

<sup>3</sup> Ernst Mach, "Analysis of the Sensations," p. 154.

cle, and gland cells, the invasion and destruction of these wasted cells by phagocytes from the blood, the filling of the spaces of these destroyed cells by the supporting tissue until the essential tissue of the organ is replaced by a tissue incapable of discharging the proper function of that organ. Hence, mental decline, muscular weakness, scant secretions, defective circulation.

Now, it is of the highest importance to observe that what we have here is only history; it is simply the description of a certain sequence of events. Old age is *explained*, you will observe, only in the sense of "the descriptive *how*," but not in the sense of "the determinative *why*." We understand, i.e., see mentally, how decrepitude comes on, not why it comes on. A moment ago we "felt no need of further inquiry," but do we not now see that another question does actually arise? The phagocytes eat up the brain cells — why? Why this self-defeating cannibalism among the members of the cell-state in one organism? The brain cells lose their plump outline and the protoplasm grows watery — why? Why should the neat equilibrium of repair and waste be upset at three-score and ten? Why this particular sequence of events rather than some other?

"As a matter of fact, never in any explanation do we reach a point where another question may

not or does not arise, and in the end, whatever the nature of our inquiry, we are brought to a stand by ultimate questions which cannot, like their predecessors, be made fresh starting-points, and yet are no true intellectual resting-places." It is precisely at this point that the limitations of science emerge. And they become all the more manifest, if with the late distinguished president of the British Association we go farther and insist that the function of science is not merely the discovery of the co-existences and sequences between phenomena, but the framing of a conception of the universe in its inner reality. For science, with all its apparatus of formula and method, with all its enthusiasm and penetration, stands before this ultimate reality as helpless as was primeval man in the presence of the starry heavens or the springtime's verdant resurrection. The riddle of consciousness itself is no farther from solution than the riddle of the ultimate reality of physical nature. A so-called law of nature, the discovery of which is, so far at least, the highest achievement of science, is nothing more than "a brief expression of the relationships and sequences of certain groups of perceptions and conceptions"; in other words, "a rule by which we can tell more or less accurately what will be the consequence of a given state of



things." It does not touch the bond of connection which holds event to event in an endless chain, nor the essence of the material of its individual links. Absolute causation and essence are both beyond the reach of the scientific plummet. Newton's law of gravitation is perhaps the greatest of all scientific discoveries, but the nature of gravity is as much an enigma to-day as it was to Newton.

Make the rounds of your fine laboratories where Science sits enthroned among her devotees. Put a few questions and mark the monotony of the answers. Here is a marvellous conjunction of crystal and brass, and in the path of the beam of light which traverses it lies a growing egg. Ask the dividing nucleus how knoweth it mathematics and mechanics, having never learned. Its sole response is the silent and uninterrupted display of its mathematics and mechanics, dividing and distributing with precision its mysterious chromatic substance. Turn to the beaming biologist at your side and ask what it is that sets this bit of matter over against the whole realm of inorganic nature. He will answer, "Life." "But what is that?" "I do not know." Ask his neighbor the chemist what he means by his oft-invoked and much-loved chemical affinity. With some preliminary skirmishing about atoms

and ions he will at last reply, "I do not know." Cross the campus and ply the physicist with the question "What is light?" "Light is radiant energy propagated by vibrations of the ether." "Yes, but what is the ether and why does it vibrate?" He cannot get beyond Lord Salisbury's famous definition, "Ether is the nominative case of the verb to undulate," and dismisses you with "I do not know." The psychologist has a nimble wit, but with persistence and care it may at length be cornered on the question "What is thought?" He may begin with the parallelism of the nerve process and the thought process, automatism or interactionism, but he will end with the confession, "I do not know."

It must be apparent that it is precisely at the crucial point in every line of research that the scientific method breaks down. When the great French chemist said, "The word *mystery* is excluded from scientific language and methods," he did not mean to say that science had now ascertained the causes of all phenomena, but simply that there were no phenomena without causes. Indeed, the farther the man of science pushes his questioning of Nature, the more oppressed he becomes with the limitations of science, and the word most familiar to his tongue is, "I do not know." It is true that the torch of science grows

brighter with each passing year and shoots its rays deeper into the enveloping darkness; but the enlargement of the sphere of light is, from another view-point, the multiplication of the points of its contact with the unknown. One secret guessed brings to view two deeper ones; Science springs more questions than she solves.

Deep under deep forever goes,  
Heaven over heaven expands.

In front of every gate out of our modern Thebes sits a Sphinx with an unsolved riddle. Even that modern Œdipus, Ernst Haeckel, essaying at the close of the nineteenth century to summarize its teaching and to solve "the riddle of the Universe," does not claim to offer a perfect solution of it, but only to show, as he himself says, how nearly we have approached to "that immeasurably distant goal." After sixty-five years of added scientific progress, we have still preserved to us Carlyle's "great, deep, sacred, infinitude of Nescience, whither we can never penetrate, on which science swims as a mere superficial film." His word of 1840 is true to-day: "This world, after all our science and sciences, is still a miracle; wonderful, inscrutable, magical, and more."

*The Relations of Science*

We have now dealt with the content, method, results, scope, and function of science. This survey has perhaps prepared us for the consideration of the relations which it sustains to life. This subject will contribute to the clearness and fullness of our view of what science is in itself, and you see that it involves directly the matter with which this lectureship is concerned. Let us think of science and life in three particular aspects of life,—physical well-being, culture, and religion. The first two will occupy us for the remainder of this hour; the last will best be postponed to the later lectures.

Manifestly the closest bonds exist between science and life in all its expressions. The aristocratic science of mathematics, self-sufficient and abstract, may indeed have established but slight connections with the actual world of experience. An eminent cultivator and apologist of this high science has declared<sup>4</sup> that its results are independent of the direction which the development of civilization has taken on this planet,—so absolute and independent, in fact, that its truths would afford the only basis of an understanding with any intelligent beings on other planets. And

<sup>4</sup> Prof. H. Schubert, *The Monist*, Jan., 1896.

yet even pure mathematics may turn to practical account as an aid in the progress of the other sciences. For it is probably true that modern science is most clearly differentiated from the vague guesses of the ancient philosophers and poets by the mathematical spirit, with its effort to measure and to count. Clerk-Maxwell said that the clock, the balance, and the foot-rule are the symbols of the scientific method. Certainly, in the case of all the other sciences, the relation to the varied modes and expressions of life is direct and close and marked by the interplay of reciprocal influence.

1. *Science and Physical Well-Being.* Of course, the most obvious relationship is presented in the practical ministry of science to life on its physical side. The evidences of this ministry are so abundant and so striking as to leave no ground to-day for that old disparagement that science stands aloof from life. It must, indeed, be admitted that the aim of science is the discovery of the rational order of the universe, with no utilitarian purpose beyond it; to find the truth of Nature for the joy of the quest, as well as for the inherent good of holding it. In fact, the investigator who sets himself the task of discovering something useful handicaps his research at the start and is rarely able to keep to the path

of his generous purpose. It has turned out, accordingly, that in most cases the man who cultivates pure science and the man who cultivates applied science are not the same. As Bacon said long ago in the very treatise which made utility the only justification of science, "the advancement of science is the work of a powerful genius, the prize and reward belong to the vulgar." And yet, remote as pure science investigation appears to be from a fruitful application in the hands of the inventor, it is in reality the condition and the germ of every such application. When Maxwell in 1873 made his great discovery of the electro-magnetic nature of heat and light, he did not foresee wireless telegraphy in it. Nevertheless, no Maxwell, no Marconi. We cannot predict definitely the practical service which the pure science work of Becquerel and the Curies will yield, though we may not question its high promise. Even if it do not turn to taxable property, it will minister to the higher utilities of intellectual satisfaction and resource.

Within the memory of some of you science has wrought more change in the conditions of life than was witnessed in the previous thousand years. It has raised the standard of comfort. We are reckoned to be sixteen times more comfortable than our grandparents were in 1850. Science has

lengthened by some six or eight years the average duration of human life. What is more important, it has heightened its efficiency ten- to fifty-fold, by improving its external conditions and by putting into its hand new forces and instruments. The rapidity and ease of communication would seem fabulous, if they were not familiar. Sectional and national barriers, if not boundaries, are fast dissolving. You have observed how quickly local questions become national, and national questions international. I am not sure that the control of Nature with which science has equipped us, its defenses against the enemies of our life that impair its tone and dissipate its energies, and the light which it is beginning to shed on the obscure problems of heredity,— I am not sure that these things do not warrant the hope of some improvement in the race itself, in its substance and texture over and above the enhancing of its physical well-being. Few serious persons will venture to set limits to the new science of Eugenics which the indefatigable Sir Francis Galton is promoting. It deals with all the influences which improve and develop the inborn qualities of a race.

Of what value after all is the ministry of science to life, if it exhaust itself upon externals? A traveller in India reports that it is no uncom-

mon thing to see a Naga from the upper valleys of the Brahmaputra, who but a few years ago was a naked head-hunting savage, now clad in a tweed coat and carrying a Manchester umbrella buying his ticket at a railway station. One cannot but fear that, in spite of his finery, he is a head-hunter still. Does science stop short with the decoration of life, and leave untouched its interior and real interests, its thoughts and feelings, its outlook and ideals, its abiding satisfactions and the higher forms of its expression? Does science bear gifts to business, and stand with empty hands before culture?

2. *Science and Culture.* We shall discover the relations which science bears to culture, if we consider the means of culture in education and the expression of culture in literature and art.

The educational curriculum in its present form is the result of a gradual growth from very ancient and rude beginnings. As in the case of a living organism, its successive modifications have been closely dependent upon its environment. Accordingly, the culture apparatus and methods of one period and race differ more or less widely from those of other periods and races. The history of this development is intertwined with the progress of external events. Of course, the widening and deepening of natural knowledge in



our time multiplied the subjects of study, and each new-comer at once challenged the preemptive right of its predecessors to the whole field of education. Many of the new subjects, moreover, yielded themselves with great hopefulness to the function of mental culture and had, besides, an important bearing on the practical conduct of life. At first a natural conservatism asserted itself in resisting any breach of the classico-mathematical discipline, but gradually gave over the struggle first in the universities, then in the colleges and secondary schools, and finally in the primary schools. The battle of the sciences for recognition in the schools is won. Universally won in theory, but the actual occupation of all the conquered territory is yet to be effected. The humanities have not been displaced and ought never to be, perhaps; but they have been forced to make room for the sciences, which have now been introduced into every stage of the educational process. Three results have followed:—The rigidity of the form of education has been relaxed, and a rational adaptation to individual capacity and need has become possible; we have acquired a new standard of educational values; and, lastly, the older subjects, rejuvenated by the contagious method of science, have now a new view-point and a changed emphasis, and have made immense

gains in interest, in culture value, and in vitality.

If we pass from the tools of education to the art of using them, we shall have to own that there has been some disappointment of the hopes which were raised by science. For the old problems of educational method remain and there is yet a distressing waste of time and the raw material in the educational process. Little children even to-day would seem to have much occasion to be thankful for that "special providence" which not only "watches over them," but somehow gets them educated in spite of their teachers. Perhaps we have blundered in ever supposing that the art of education, any more than other provinces of life, could be reduced to the mechanical exactitude of formal science. And yet is there not a discernible movement of that art in the direction of science? The scientific study of the contents and development of the child mind, though but just begun, has thrown light upon its normal interests and its successively arising needs, and has materially transformed educational theory and practice for the better. And it would be unfair and unwise to discredit so soon in the field of education a method which has been uniformly successful elsewhere.

Literature is the exponent and standard of culture. It is one of the chief forms in which the

higher capacities of man shine out and make record of themselves. Do its contemporary phases show any traces of the scientific revolution? How has it responded to the pressure of the new knowledge?

In a period whose intellectual interests lie pre-eminently in the body of scientific truth, when science is the support and comfort of the humblest life, as well as the basis of wellnigh the whole of our thinking, one would expect the rise of what we may be permitted to call — *pace* Mr. Matthew Arnold — a distinctively scientific literature. It has come, and in enormous volume. There is, besides, a deep tinge of science in the highest forms of recent literature, as in Tennyson and Browning, while the problems of sociology, psychology, and heredity often supply the *motif* of popular fiction.

Of course, the history of the literary response to the touch of science is complicated by the co-existence of widely different attitudes and the survival into a later time of impressions and effects which logically belong to an earlier stage of the development. Let me suggest the chief stages of this logical development.<sup>5</sup> The first contact of the new knowledge with literature awakened

<sup>5</sup> Quoted with some expansion from the author's "Laboratory and Pulpit," 36, 37.

the fear that the poetry of life, its sentiments and ideals, would be rudely dealt with by the hard and fierce man of science who bustled on to the stage with the chatter of instruments, with a pigeon-hole and a physical test for very phenomenon of the soul. In 1829 Edgar Poe cried out to science,

Why preyest thou thus upon the poet's heart,  
Vulture, whose wings are dull realities?

About the same time Keats revolted no less strongly against the ruthless extension of scientific explanation, which seemed to him to break the wing of imagination and to destroy the beauty of the world by dissecting it. The feeling is finely delineated more recently by Walt Whitman:—

When I heard the learn'd astronomer;  
When the proofs, the figures, were ranged in columns  
before me;  
When I was shown the charts, and diagrams, to add, divide,  
and measure them;  
When I, sitting, heard the astronomer, where he lectured  
with much applause in the lecture-room;  
How soon, unaccountable, I became tired and sick,  
Till rising and gliding out, I wandered off by myself,  
In the mystical moist night air, and from time to time  
Looked up in perfect silence at the stars.

And what severer indictment could be brought against science than this of Amiel, certainly one of the most brilliant and deeply instructed of

modern critics, who, in deprecation of what he calls the laboratory smell of Taine's "English Literature," says, "I imagine this kind of thing will be the literature of the future, . . . as different as possible from Greek art, giving us algebra instead of life, the formula instead of the image, the exhalations of the crucible, instead of the divine madness of Apollo. Cold vision will replace the joys of thought, and we shall see the death of poetry, flayed and dissected by science."

Following this stage of fear and revulsion come bewilderment and pessimism at sight of Nature "red in tooth and claw with ravine," and the deep tragedy of life palpitating in the grasp of inexorable law: — as Thomson puts it in "The City of the Dreadful Night,"

The sense that every struggle brings defeat,  
Because Fate holds no prize to crown success;  
That all the oracles are dumb or cheat,  
Because they have no secret to express.

The feeling often shadows the brow of Tennyson and is the characteristic note of Arnold and "the scornful yet terrified" Byron. The complete surrender to the scientific impression is seen in the naturalism of Zola and Thomas Hardy, who frankly accepted and utilized the new knowledge, turning it into the bricks and mud of realism. After it follows the transfiguration of Nature

such as one finds in Richard Jefferies, George McDonald, and Watts-Dunton. The final stage of sympathetic response and adjustment is reached when genius awakes to the new material which science lays at its feet, and is kindled into triumphant faith and optimism by the wide vision of evolution. That is precisely the distinction of Robert Browning.

It is interesting to observe that this issue was divined by Wordsworth's infallible insight before the development which I have sketched begun. In the preface of the "Lyrical Ballads" (1800) he wrote: "Poetry is the breath and finer spirit of all knowledge; it is the impassioned expression which is in the countenance of all science. . . . If the labors of men of science should ever create any material revolution, direct or indirect, in our condition and in the impressions which we habitually receive, the poet will sleep then no more than at present; he will be ready to follow the steps of the man of science, . . . carrying sensation into the midst of the objects of the science itself."

Against such high authority and the testimony of recent literary history, the question is still asked, can poetry survive in the cold white light of science? Does not imagination, which is the real poet, pass with mystery into banishment

under the decree of science? Was not the early protest of the poets just and rational, after all?

It may be replied, in the first place, that the work of the scientific investigator and the work of the poet, so far from being incompatible and mutually exclusive, show, if one look beneath the surface, a deep and inherent affinity. As I have pointed out, the process of a research is briefly this: "Observation starts a hypothesis and experiment tests whether the hypothesis be true or no." In his "Life of Claude Bernard," Sir Michael Foster says: "It is in the putting forth the hypothesis that the true man of science shows the creative power which makes him and the poet brothers. He must be a sensitive soul ready to vibrate to Nature's touches. Before the dull eye of the ordinary man facts pass one after another in long procession, but pass without effect, awakening nothing. In the eye of the man of genius, be he poet or man of science, the same facts light up an illumination, in the one of beauty, in the other of truth. Each possesses a responsive imagination. Such," he continues, "had Bernard, and the responses which in his youth found expression in verse, in his maturer and trained mind took on the form of scientific hypotheses."<sup>6</sup>

<sup>6</sup> Cf. Balzac, "Wild Ass' Skin,"—"Is not Cuvier the great poet of our era?"

Moreover, let us not confound the activity of the poetic imagination with the materials which it employs. Surely it is not an owl — this highest of our powers — an owl getting abroad only in the dark, and limited in its range by certain traditional boundaries. It is, indeed, true, as Edgar Poe lamented, that the day-spring of scientific truth has driven the hamadryad from the wood, the naiad from her flood, and the elfin from the green grass, except perhaps in Norway at the limit of European civilization, on the outskirts of which, we are told, the great primitive gods still dwell and where elves and fairies and mermaids are still regarded as domestic animals. But if the fairies are gone, are there no “fairy tales of science,” to use a phrase of Tennyson’s? Wherefore should the poets, says Browning, seek to —

Recapture ancient fable that escapes,  
 Push back reality, repeople earth  
 With vanished falseness, recognize no worth  
 In fact new-born unless 'tis rendered back  
 Pallid with fancy. . . .

Let things be — not seem,  
 I counsel rather,—do, and nowise dream!  
 Earth's young significance is all to learn.

The banishment of the pretty fictions of the Greek and Scandinavian mythology, which, it may be observed, have been in exile now many centuries,



in no way impoverishes the imagination. Indeed, this great instrument of scientific progress has not only been trained by it, but has been enriched by a wealth of materials which endows it for the highest possible creative tasks. If it still require for stimulus and food the sense of wonder, it need not stop with Lowell's crumb —

Faith and wonder and the primal earth  
Are born into the world with every child,—

but press on into the deeper physics and biology of the day to find mystery still at the heart of universal Nature, and the sum of things more vital, more wonderful, more majestic and beautiful than ever it was in the twilight of the sciences. Imagination has reconstructed the geological past of the earth and the systems of the world of stars. The possibility of a similar inductive knowledge of the future has scientific sanction, and what a world for imagination is there:— The new element for the vacant space in Mendeleef's table, the new planet which vexes its sister in the dark, the new flower or fruit asleep in divergent types, the new light about to spring, the new society coming forward out of the future to meet us, the fascinating question, What is to come after man?

Permit me to add that the hypothesis which

these observations suggest, namely, that the progress of science has not been unfavorable to creative literature, has been already verified by the test of experiment. Neither the quantity nor the quality of poetry shows any abatement under the influence of the all-conquering science of our time.

Art is so closely akin to the highest literary form that it is not necessary to speak in detail of its relation to science. De Quincey's classic distinction between the literature of power and the literature of knowledge is exactly paralleled by Ruskin's distinction of two sorts of painting. The literature of knowledge, according to De Quincey, merely transcribes the fact, nothing more; the literature of power gives us, not the fact, but the writer's sense of the fact, or, as Browning puts it, "fuses his live soul and that inert stuff." It is just the difference between chronicle and history, between a coast survey and Wordsworth's sonnet, with its "gentleness of heaven is on the sea" and its "Nun breathless with adoration." And so Ruskin speaks of topographical and mechanical painting, which is concerned only to reproduce faithfully every detail of a landscape as it is, and, on the other hand, a totally different kind of painting, which gives not the actual facts of the artist's subject, but the impression which it made on his mind. I need not

remind you that the literature of power is the only kind of literature, and that a camera is not an artist. Any work of art, whether pictorial or plastic or poetical, is primarily a reflection, not of the external world, but of the soul of the artist.

It is clear, therefore, that the artistic impulse, like the brush and chisel which in secluded studios beautified Florence even while the populace were fighting in the barricaded streets, is "safe in uncontaminate reserve" against any outward violence. Safe also, so long as imagination and emotion are essential features of human nature, against deterioration into the camera type; for it cannot deny itself. So far from reducing art to one of its own branches to record the demonstrable fact like a sensitive machine as Zola prophesied it would do, science in reality widens the horizon of art and deepens its penetration and enlarges the treasury of ideas from which its emotion may flow out into forms of beauty.

And here again the actual history is available to test the validity of these antecedent considerations. At the beginning of the Victorian era stagnation is said to have characterized the art of England, while contemporaneously with the scientific development of that era there was a revival of English art, and to-day the critics recognize an English school of art. It was, therefore,

fitting and symbolic of contemporary culture that John Ruskin, the herald and prophet of the revival of English art, should have designed, as he himself tells us, the first window of the façade of the museum of Oxford, in which was inaugurated the study of natural science in England, in true fellowship with literature.



**LECTURE III**  
**SCIENCE IN RELIGION**

*My own East!  
How nearer God we were! He glows above  
With scarce an intervention, presses close  
And palpitatingly, his soul o'er ours;  
We feel him, nor by painful reason know.*

— Browning, *Luria*.

*Science was Faith once; Faith were Science now,  
Would she but lay her bow and arrows by  
And arm her with the weapons of the time.*

— Lowell, *The Cathedral*.

## SCIENCE IN RELIGION

**T**HE concluding part of the last lecture was an inquiry into the relation of science to physical well-being and to culture. We come now to ask how science stands related to the highest expression which life takes,— its response to the call of the universal Spirit behind and within all nature. How has the religious life fared during the reconstruction of the economic and intellectual life? Has faith lost its way in our roomier universe? Does it find the new climate wholesome? Is it able to live and thrive in this scientific atmosphere?

In observance of the Socratic dictum quoted early in our joint studies and in preparation for this last inquiry, we need to seek a definition of religion, at least to make sure of what we mean when we use the term. Whereupon I think we shall find science in religion and religion in science.

I am venturing, I know, to speak of music in the presence of Wagner. But I remember that the simple hop-waltz, the jig, and the folk-song have in the hands of the music-masters grown up into the classic form of the symphony. May I suggest, in further extenuation of this rashness,



that the combination of the non-professional with the professional view, especially in a matter so deeply human as religion, may issue in a stereoscopic solidity and clearness of outline which either view alone might lack. Moreover, the present discussion may seem in your expert eyes to be the less presumptuous, if you will be good enough to remember that it aims to set forth a particular aspect of the non-professional view, treating religion as a natural phenomenon and approaching it from the side of natural history.

*What is Religion?*

There are said to be ten thousand definitions of religion. I have no wish to add another. For the practical purposes of the religious experience they might all be dispensed with. The race of men endowed with the highest religious genius was least given to speculation. Conduct, not abstract truth, is the concern of the Hebrew; life, not the philosophy of life. He felt little need to translate into terms of intellect the facts of the inward experience. His interest and effort were all discharged upon the experience itself. Accordingly, we shall look in vain for formal definitions in the Bible. We do find in the Old Testament concrete descriptions of the ideal life, as in Micah: He hath shown thee, O man, what

is good; and what doth the Lord require of thee, but to do justly, and to love mercy, and to walk humbly with thy God? And in the New Testament Jesus' condensation of the law and the prophets into the one word love, and James' picture of genuine religion as kindness and purity, occur to one at once. But these are not definitions. This absence of theorizing about religion in the very literature which has come to be the support and the authority of the religious life, is full of instruction for our hair-splitting Western race, which, in its eagerness to be logical, sometimes forgets to be good. It is precisely this habit of intellectual review and analysis which has brought us into the necessity of such a discussion as the present. Centuries of reflection and debate have produced a progeny of more or less definite and co-ordinate conceptions of religion, and now that science has come with a new mental brood, we have discovered, as we think, some discord in the family of our ideas, and must set about quieting the theoretical trouble.

In the effort to find the essential elements of religion, observation of the phenomenon as it actually occurs in the world of mankind is obviously our first duty. Of course, to be most useful the observation must be as wide as possible. The most rudimentary stages of the religious

development need to be represented, as well as the most advanced. But it is in regard to these backward or degenerate forms of religion that our information is scantiest and most contradictory. The observers upon whose reports we have to rely have met varying obstacles among the different peoples studied and have themselves been variously equipped for their task. This will explain the greater part of the divergence of their reports. The chief obstacle to getting at the heart of primitive religions is what seems to be a native and universal reserve which shields the inner life against vulgar intrusion. It has sometimes been misinterpreted. The silence of the savage about his religious conceptions has been taken to mean that he had nothing to communicate, and the traveler returns to tell the world that such and such a tribe has no religious ideas and sentiments. It requires a more or less prolonged intercourse and a thoroughly sympathetic bearing to call out of their hiding these intimate revelations. Accordingly, the missionary is as a rule the best observer. No one else has the motive which justifies the long and kindly association. And yet some missionaries, handicapped by a definition framed at home and incapable of respect for any so-called false religion, have been unable to give any reliable account of the religion which

it was their business to displace. The attitude of Dr. Nassau is the true and hopeful one. When he went forty years ago to live among the savage negroes of West Africa, he did not think it reasonable, he tells us, to dismiss curtly as absurd the cherished sentiments of so large a portion of the human race. We are not surprised to find so rich a harvest of first-hand, trustworthy observations in his recent book on Fetichism.

It need hardly be said that the origin of religion is under the same veil of mystery which envelops all beginnings. When the stream of the individual consciousness took its rise, it blew no trumpet, it set up no stakes, it wrote no record; and no man knows the place of it. Even more secret and inaccessible are the sources of the tribal consciousness, what religious content they held in solution, and whence it was derived. Deeper still in the irrecoverable past lie the fountains of the racial consciousness. All that we can say of it is, that where it first emerges from the mist-wreathed mountains of its origin and comes plainly into view, it is already deeply tinged with religion. And yet, in spite of the impossibility of getting at the origin of religion to make observations upon it, the question is so seductive that anthropologists seem to maintain their enthusiasm in research mainly in the hope of being

able to throw back upon it some light from phenomena that are still accessible. The facts which they have observed suggest, of course, some hypothesis of origin, but the difficulty is that the hypothesis cannot be put to experimental test. Its highest justification is that it accords with all the known facts of the case and unifies them. It cannot take rank as a scientific law, in the sense in which we use that term; it is only a working hypothesis.

One meets in current discussion several of these hypotheses of the origin of religion. There is the ultra-conservative theory of an original divine revelation transmitted to the branching races of men by tradition. There is the mystic's theory of a sixth sense, the *sensus numinis*, intuitive and, like reason, native to every man. Another theory supposes that the spiritual beings with whom religion is concerned were simply the projection of primitive man's own conscious powers upon the mists of the unknown. The theory, held by Herbert Spencer, Mr. Tylor, and most anthropologists, known as the "ghost theory," supposes that primitive speculation on sleep, trance, death, and the human shapes seen in dreams, led to the conception of a phantom or ghost-soul, separable from the body; hence, the world of spirits and ghosts, and God the greatest

of the ghosts.

With this brief allusion we must dismiss all these working hypotheses except the last. Permit me to remind you of the recent work of Mr. Andrew Lang,<sup>1</sup> which seriously compromises, if it does not entirely discredit, this hitherto orthodox scientific ghost-theory. He finds amidst the confusion of low savage faith a germ of pure, though inarticulate, religious belief, which in an earlier stage may have been even less overlaid with fable. For example, the lowest of all human races, the Australian, has attained a religious conception far above what savages are usually credited with, and it is clear that he has not done so by way of the ghost-theory, for in the Australian's creed neither sacrifice nor ghost-worship has any place. Note this Bushman's confession to a friend: "Cagn made all things, and we pray to him, O Cagn, are we not your children? Do you not see our hunger? Give us food."<sup>2</sup> In Africa, says Dr. Nassau, belief in one great Supreme Being is universal. He goes further and declares that during his long residence among the Western tribes he saw or heard of none, even among the most degraded, whose religious thought

<sup>1</sup> "The Making of Religion," 1898; "Myth, Ritual and Religion," 2 ed., 1899.

<sup>2</sup> Lang, "Myth, Ritual and Religion," II, 36. Cagn = the insect, *mantis*. Cf. Encyc. Brit., 11 ed., XIX, 135.

was only a superstition.<sup>3</sup>

It was upon the basis of such facts as these that Mr. Lang reconsidered his former view which coincided with Mr. Tylor's, and came to look upon a form of theism as the primitive expression of the religious consciousness, and furthermore to see that the religion of the lowest races, in its highest form, does in reality sanction morality. He confesses that, like others, he had thought savages incapable of such relatively pure ideas, but being unable to resist the evidence, he abandoned his *a priori* notions. His present position he summarizes in these words: "Not only the puzzling element of myth, but the purer element of religious belief sanctioning morality is derived by civilized people from a remote past of savagery." With this general conclusion agrees that eminent authority, the late Dr. Brinton, who goes, indeed, a step beyond the English writer. He feels no hesitation, for example, in saying that, while the very dawn of the religious consciousness is lost behind the impenetrable mists of the early Stone Age, its explanation is simple and universal. For man is man whenever and wherever you find him. As the Spy and Neanderthal skulls are distinctly human skulls, so the mode of mental action and the ground ideas of man are always the same,

<sup>3</sup> Nassau, "Fetichism in West Africa," 36, 38.

whether one discovers him swinging into place the monoliths of Stonehenge or suspending in mid-air the dome of St. Peter's. We may not be justified in holding with a German ethnologist the extreme determinist view that the human mind is a machine which, supplied with "the same materials, will infallibly grind out the same product"; "we do not think, thinking merely goes on within us." But we cannot refuse to accept the mass of ethnological evidence now at hand pointing to the identity of mental construction and action from the earliest and rudest type down to the latest and highest. "The same laws of growth which develop the physical man everywhere into the traits of the species act also on his psychical powers, and not less absolutely, to bring their products into conformity." This simple fact explains the striking similarity in primitive religious ideas. We have no need to invoke either historic connection or tradition from a common ancestry. The mind of man reacting in practically the same way to the same stimuli will everywhere reach fundamentally identical conceptions. This is true of the realm of the arts and institutions no less than of religion.

Now, what is the fundamental and therefore universal reaction of the human mind in the midst of the manifold forms and ordered activities of the natural world? It is, in Dr. Brinton's words,

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the recognition "that conscious volition is the ultimate source of all force. It is the belief that behind the sensuous, phenomenal world, distinct from it, giving it form, existence, and activity, lies the ultimate, invisible, immeasurable power of mind, of conscious Will, of Intelligence, analogous in some way to our own; and,— mark this essential corollary, that man is in communication with it"<sup>4</sup> This recognition or assumption is at the foundation of all the spontaneous or primitive religions, and, with the curious exception of Buddhism which is less a religion than an ethical philosophy, likewise of the founded or salvation religions. From this point of view the significance of Jesus lies in the personal revelation which he made of the abstract universal Intelligence as being in sympathetic neighborhood to human need, and in his clearing the way for freer commerce with the unseen. As Paul expressed it, "God was in Christ reconciling the world unto Himself." Jesus' companions and interpreters felt that they had heard, had seen with their eyes, and had handled with their hands somewhat of the eternal Life, and that through Him they had a freshened fellowship with the Father.<sup>5</sup>

<sup>4</sup> Brinton, "Religions of Primitive Peoples," 47.

<sup>5</sup> I Jno., 1:1-3.

*The Religious Crisis*

This general survey of the religious phenomenon brings into view its universal elements,— what may be called the religious element proper and the mythical element. The distinctively religious element is that which recognizes and opens correspondence with the unseen Powers. The mythical element taking objective expression in ritual is the product of the religious. It speculates about the world of the Powers, and is invariably responsible for the religious crisis. Its elaboration of animistic ideas and beliefs sometimes overflows the purer germ of religion and supersedes it. For there seems to be little check upon this primitive fancy and speculation. In West Africa, for example, where “any system of atheism strikes the people as too absurd for denial,” God is supposed to have withdrawn from the world after creating it and to have allowed it to fall under the control of evil spirits. It is only to these evil spirits, accordingly, that worship is paid. The people say, “God is far from us. He does not help or harm us. Why should we care for him?”<sup>6</sup> Here the mythical factor is supreme in the religious life, and its speculations cannot escape the criticism of a higher culture so soon as it arises.

<sup>6</sup> Nassau, “Fetichism in West Africa,” 38, 39.

The case of the religion of the ancient Greeks is a more instructive example, because in it the development went forward to a further phase, which is analogous to the current situation of Christianity. The brooding of the poetic imagination upon the central conceptions of religion generated in the course of time the intricate mythology of the heroes and Olympian divinities. It is these very personal and vital men and women, gods and goddesses, of whom we read in Homer. The poet does not discuss abstractions and general principles, nor define the relation of the divine world to the human. He writes the glowing history of very real personages in the midst of whose struggle on the plain flash to and fro the no less real Athene and Ares and Aphrodite for guidance or for succor. The pale cast of thought, we may be thankful, came later. But it came. With the rise of abstract reflection the poet and his beautiful creations had to face the critic. It was inevitable. For the essential content of the religious consciousness is always at war with the particular and limited form in which it happens to find expression. Criticism, at first in alliance with this essence, exposes the unreality of the form, undermines the mythology, objecting that it lowers the spiritual to the level of the natural; and then, upon the destruction of the form, it begins to question

the existence of the spiritual essence itself. "Superstition bowing down before an idol, *just as an idol*, provokes the unbelief which refuses to worship even the god. And rationalism which begins by pointing out that the myth is not true as the expression of a simple fact, ends in the denial that there can ever be anything more than a simple fact to express."<sup>7</sup>

The critical era for Greece came with the closing years of the fifth century B.C. A new national experience combined with the rise of abstract thought to produce the widespread skepticism of the Sophistic movement, which involved not merely religious beliefs but all knowledge "in one general web of distrust." The Sophists after laying bare the emptiness of the popular faith, coldly turned their backs on all religion and gave attention solely to preparing their pupils for achieving a successful practical career.

The modern counterpart of this development is the rise and dominance of the mediæval theology and the critical movement of the eighteenth century known as the Enlightenment, continued in the nineteenth century as Positivism or the disillusionment of science. One of the most striking facts in the history of Christianity is the increasing obscuration of its inner life and essence down to a re-

<sup>7</sup> Caird, "Evolution of Religion," I, 298.

cent period. According to Jesus, religion, *i. e.* His religion, is love to God and man. According to His brother and apostolic interpreter, it is purity and kindness. According to the most gifted and influential of His successors, Christ Himself, in His own person, is all and in all. In other words, the essence of Christianity is an inward disposition, not an external connection. It is a personal attachment, not subscription to intellectual propositions. It is a close and easy correspondence with the Father through Christ, who came out from Him to dwell among us and returned to Him bearing our confidence and love, "the grandeur God" becoming for us "the comfort Christ." But the historic development has been away from this fundamental conception. The mythical factor came early into play, and inasmuch as men had long before found their way into the world of abstractions, this mythical factor, which in a rude or poetic people had elaborated ancestor-worship, or fetichism, or a rich mythology, now exercised itself mainly in the creation of a complex ritual and a co-ordinated body of doctrine. Indeed, a distinguished European ethnologist declares that even fetichism is by no means unknown to-day to Catholic Christianity and its cult. The church, Western and Eastern, builds about itself a high thorny hedge of so-called articles of faith chosen

after hot debates in councils and synods, and then with a serene authority declares that there is no salvation for those on the outside. Tolstoy's faith in the church was chiefly shattered, so he says, by its indifference to what was essential in Jesus' teachings and its avidity for what was of secondary importance. Is the lapse from the conception of Jesus less real in Protestant Christianity? From being a renewed life, has it not been largely transformed into the acceptance of a body of religious beliefs? What but this can be the meaning of the perplexity of an American theologian held in the highest regard by us all? "When I think," said he a few months ago, "how little Peter and James and John, on the banks of the Jordan at the beginning of Christ's ministry, knew about Christian doctrine, I am amazed that they should have been counted among His disciples. If you had asked them about the deity of Christ, or about the atonement, they would not have understood the meaning of your words." He is able to resolve the incongruity only by suggesting with an interesting and artless candor that "all Christian doctrine was latent in their obedience."<sup>8</sup> And is not our militant denominationalism another expression of the same lapse? Tests which are purely intellectual are applied at the entrance of

<sup>8</sup> Strong, "Our Denominational Outlook," 1904, pp. 21, 22.

very many Christian communions, and the discredit of erroneous opinions sometimes extends beyond the ecclesiastical close to bar admission to other associative groupings. Mr. Justin McCarthy recalls the fact that about 1872 one of the most influential of the London journals sneered at the Parliamentary candidature of Professor Fawcett, on the ground that he was a man who, as a believer in the Darwinian theory, admitted that his great grandfather was a frog. One must think "right" at the peril of one's salvation both in this life and that which is to come. If one think "right," the Powers will relax somewhat the demand for goodness. Such a requisition would not seem to be particularly severe upon so superlative rational powers as Augustine had, or Calvin, or St. Thomas, or John Stuart Mill. But what would become of us ordinary mortals, who can hardly be brought to think at all? In the *Journal of Eugenie de Guerin* we read of the arrest and condemnation to burning of a poor shepherdess who carried off in her apron the blessed sacrament from an empty church and placed it under a rose-tree in the wood. When about to die she confessed to a priest that she only wanted to have the blessed sacrament in the forest. "I thought," she said, "the good God would be as satisfied under a rose-tree as on an altar." But she was

burnt. And of what account was the consecration of the simple-hearted colored preacher whom I knew, if along with it he had not been "sound" in doctrine? In terms not altogether pleasing to an over-refined taste, he said one day: "I jes' feel like I must go to Africky as a missionary. An' ef them men-eaters gits me, it'll be all right. Eben out'n ole George's hash thar'll rise up a sweet savor unto de Lord dat'll glorify his blessed name."

Let me give you in some detail for its illustrative value the twelfth-century French legend of "Our Lady's Tumbler." It is the story of a travelling minstrel who grew weary of the world and entered the monastery in Clairvaux. He had spent his life in tumbling, leaping, and dancing, and knew nothing else,—no paternoster, no chant, no credo, no ave, nor, in the language of the legend, "aught that might make for his salvation." He was abashed among the priests, deacons, sub-deacons, and acolytes, who all had tasks in season, while he was able to do nothing suitable to so holy a place. In his grief he came one day upon a crypt in the monastery where was an altar and above it the form of the Holy Mary. The signal for the Mass sounded, and he was dismayed. "Ah!" he cried; "now each will say his stave, and here am I like a tethered ox, doing



naught but browse.— Shall I say it? Shall I do it? By the Mother of God, I will! I shall ne'er be blamed for it, if I do what I have learned, and serve the Mother of God in her monastery according to my trade. The rest serve in chanting, and I will serve in tumbling.” Laying off his cloak, he takes his stand right humbly before the image. “Lady,” says he, “to your protection I commend my body and my soul. Sweet queen, sweet lady, despise not what I know. I can nor chant nor read to you; but, certes, I would pick for you a choice of all my finest feats.” Then he began his leaping and tumbling and dancing, at intervals throwing himself on his knees before the image to salute and adore it. He arose and in festal guise made the vault of Metz around his head, and turned and saluted the image. Then he did the French vault, and the vault of Lorraine, and then the Roman vault, and with his hand before his brow he danced most featly as he gazed humbly at the image. “Lady,” he said, “this is a choice performance. I do it for no other but for you and your son. And it is no play work. But I am serving you for your disport, and that pays me. Lady, despise not your slave.” When he heard them raise the chants, he laid to in right good earnest, and as long as the Mass lasted he ceased not until he dropped upon the ground for weariness.

“Lady,” he said, “I can do no more now; but, indeed, I will come again. Adieu, sweetest friend. What pity that I know not all those psalters! Right gladly would I say them for love of you.” This life the good man led long time in secret. At last the Abbot witnessed one day all the minstrel’s office, and when it closed he saw a glorious Dame descend from the vault with angels to sustain and solace her exhausted servant. The mediæval writer, with the simplicity and true religious instinct which shine all the brighter for the elaborate formalism and official theologies of the time, thus points the moral of the story: “God rejects no one who comes to him in love, of whatever trade he be, if only he love God and do right.”

Thus the simple devout. But the great leaders — what of them? No clearness of spiritual vision, no shining of the face of prayer, no depth of the hunger for righteousness, no mounting up of the passion for perfection, no brightness and purity of life recovering the stained and the stumbling, no strength of hand for blessed ministries, can set at rights, or make amends for, a slip in doctrine. My Lady Macbeth, Theology, or, if you prefer, Ecclesiasticism, finds it hard to wash out the stain of blood shed for opinion’s sake, and all Araby’s spices cannot sweeten that hand again.

And the horrible business of religious persecution is not finished yet. I greatly fear that not all the Johannes Agricolas have yet "laid their spirits down at last in God's breast," but some remain with us who, at the demand of the dogma, complacently might —

Gaze below on hell's fierce bed,  
 And those its waves of flame oppress.  
 Priest, doctor, hermit, monk grown white  
 With prayer, the broken-hearted nun,  
 The martyr, the wan acolyte,  
 The incense-swinging child,— undone  
 Before God fashioned star or sun!  
 God, whom I praise; how could I praise,  
 If such as I might understand?

We have seen that the mythical factor co-exists with the religious factor in the rudest as well as in the most advanced religions. It finds expression now in an exuberant animism or mythology, now in ritual, now in dogma. In the case of Christianity, its Hebrew ancestry imposed some checks upon the universal tendency to speculate about the content of the religious consciousness. Accordingly, in its earliest forms the moral and spiritual elements allowed little place for the reflective. As late, indeed, as the close of the second century Celsus, the first pagan critic of the new religion, repeats as a reproach practically the same thing which Paul had counted a distinction

of the Gospel,—“not many wise men after the flesh are called.” But when once Christianity, spreading beyond Hebraism, came into living contact with the Hellenic culture, the obstruction of racial inaptitude and the restraint of Jesus’ own teaching were no longer operative, and, as Professor Edwin Hatch declared, within a century and a half after this first contact, the ideas and methods of philosophy flowed in such mass into Christianity as to make it no less a philosophy than a religion.<sup>9</sup> It is not unlikely that the speculating tendency received additional stimulus as well as materials from the Pauline letters, which for the most part arose out of the necessity which was upon him to vindicate his Gospel by dialectical methods before the bar of Jewish learning. A transient necessity was misinterpreted as establishing an authoritative precedent and fixing the emphasis where it does not belong.

Now, the historic eclipse of the vital, personal, practical idea of Jesus, this shifting of the emphasis of the Christian experience from life to opinion, led directly to the superstitions, the formal creeds, the extravagancies, and tyrannies which precipitated the eighteenth century crisis of the Enlightenment and the nineteenth century crisis of the

<sup>9</sup> Hatch, “Influence of Greek Ideas and Usages upon the Christian Church,” 125.

scientific criticism. Only the latter concerns us here. It was inevitable. For the elaboration of opinion under religious sanction ranged over well-nigh the whole world of fact. It involved cosmogony, ethnology, and history. It had its theory of the earth and of the heavens, of disease, of language, of education. But all those matters were manifestly within the scope of science and subject to its revision.

The first contact of the new natural knowledge with the body of religious opinions was in many serious minds disastrous. The great scientific generalizations mentioned in the first lecture at fundamental points antagonized squarely the world-view which had grown up under the sanction and protection of Christianity. They date this side of 1830. The next decade is the precise period when the ghost of doubt begins to haunt the heights of English culture. Here begins what has been called the modern tragedy of opinion. It is just then that Carlyle cries out bitterly, "Nothing, or almost nothing is certain to me!" Froude says that he and a band of companion truth-seekers were driven to the wilderness in search of some certainty on which they might rest. Tennyson, in his poetic seclusion, had moments of dark misgiving, when he could only "stretch lame hands to God," and "trust that somehow

Good will be the final goal of Ill." Francis Newman and George Eliot in these same revolutionary years bade adieu to their ardent evangelicism. Matthew Arnold's early poems, tinged with the sad beauty of a pagan despair, bear testimony to the stress of the time, when, as he complains,

The old is out of date;  
The new is not yet born.

And Arthur Clough's devout fine spirit returned no more to port from drifting on the ocean of doubt.<sup>10</sup>

If the religious life itself did not suffer asphyxia in these and other gifted minds, religious beliefs underwent serious disintegration, and in some of them were swept entirely away. A storm was on the high seas, and many a fair sail that ventured into it split and sunk, and many that lived through it bore ever afterwards the marks of its distress. But it could not have been otherwise. Is not the way of light always a narrow way beset with fatal perils? An ocean without storms is an ocean without life, and some craft must go down if any are to sail. Human nature is so constituted that it must struggle into its larger hopes, and it is an inevitable incident that some perish in the transition. The pain and peril of such a time are

<sup>10</sup> Cf. Tullock, "Movements of Religious Thought in Britain," Ch. VII.

none the less real when they are scientifically explained; but they become less terrifying. We now recognize them as growing pains, as due to the less successful efforts of the religious consciousness to adjust itself to a new situation. New, *i. e.*, to the existing religious consciousness. As we have heretofore noted, in the historical development of religion such a crisis is not new. "It hath been already in the ages which were before us." The external situation which precipitates the crisis is all that varies from age to age. And even these situations, as we have seen, have the common character of a widened experience, which wakes up the critical faculty to review the creations of fancy and speculation grown up in the interval of its dormancy.

Of course, from the view-point of those who speak authoritatively for religion, the critic is the heretic or the infidel, according to the extent of his negations. And every religion which has reached the stage of criticism, and every time such a stage is repeated, can show examples of this interesting person. Sometimes, like the prophet of the ancient Hebrew religion, he is gifted with originality and insight, and shatters the forms of worship to save the heart of it. Sometimes, like Socrates in the Greek crisis, your infidel repudiates a poetical mythology and introduces the spiritual

conception of the Divine Being in the marketplace, endangering the traditional rites on which the fortunes of the State depend. Or, like Lucretius in the Roman crisis and Haeckel in the nineteenth century crisis, in the name of science he rejects all religion along with a particular expression of religion which he has identified with its essence. And now it is Marcion of the second century, a man of deep religious character, who revolts from the mixture in current Christianity of eclectic paganism and Gnostic speculation, and makes the first rupture of the dogmatic unity of the church on the issue of the return to the simplicity of the original Gospel. Or it is that apostle of the eighteenth century Enlightenment, Voltaire, that incarnated smile, who, disgusted and indignant at the bigotry and injustice of organized Christianity, upon the monstrous death of the poor Huguenot by priestly authority, raised in behalf of outraged humanity a defiant shout which well-nigh shook to its ruin every religious establishment in Europe. He built a church on his estate and, in impatience at the endless list of saints to whom most churches were dedicated, he, in his own person, dedicated this simply to God; we read of his communing in it later. And when the Lisbon earthquake shattered not only houses, but over a wider area the faith of many, who but this smiling infidel uttered



the call to faith in an inscrutable Providence in view of that catastrophe? And yet the uncritical tradition of Roman Catholic abuse spreads beyond that communion and comes down to our own day. And I should like to speak of the pugnacious Professor Huxley of the keen rapier, who more than once made life uncomfortable for English bishops — Professor Huxley working in his old age on a Bible story-book for children, and possessing, according to an extravagant friend,<sup>11</sup> enough real Christianity to save every man, woman, and child in the British Isles, with plenty to spare.

But I wish to speak more particularly of two other cases, and from the point of view of their own inward experience. The first is the deeply instructive experience of one of the most eminent of contemporary biologists and psychologists. The late Professor Romanes made years ago a severely rational and candid examination of theism, and reached sadly a wholly negative result. And yet with his own unanswered arguments before him, his deeper nature rebelled against the deliverance of his reason, and still cried out after God, reminding us of what Dr. Johnson once said about the appearance of a man's spirit after his death, "All argument is against it, but

<sup>11</sup> Cf. *The Atlantic Monthly*, Feb., 1901, p. 283.

all belief is for it." There were times when Romanes' habitual repression of these deeper longings relaxed and he poured his heart out in the tenderest of poetic appeals. Read his sonnet beginning "I ask not for thy love, O Lord," and closing with these words:

I ask not for Thy love; nor e'en so much  
As for a hope on Thy dear breast to lie;  
But be Thou still my shepherd — still with such  
Compassion as may melt to such a cry;  
That so I hear Thy feet, and feel Thy touch,  
And dimly see Thy face, ere yet I die.

He meditated deeply on this antithesis in his own nature. He lived to resolve it. Only two months before his death he wrote to a friend,— what seems to have goaded Haeckel into an unworthy effort to discredit the validity of the experience, — that he was beginning to see the truth that logical processes are not the only means of knowledge in transcendental regions. In his remarkable posthumous notes on religion, he declares that reason is not the only attribute of man nor the only faculty for the ascertainment of truth; that the moral and spiritual faculties are of no less importance. In the rational sphere he was critical and agnostic; in the sphere of essential religion he was devout and responsive. With the vivid recognition of the necessity of faith and of the

legitimacy and value of its intuitions, he died in full and deliberate communion with the church of Jesus Christ.

Consider now the experience of a Biblical critic of the first rank, the historian of the origins of Christianity. In that remote and wild district of northwest France, Brittany, there is a popular legend of an imaginary town called Is which was swallowed up by the sea long ago. The fishermen say that the tops of its church spires can be seen in the hollows of the waves when the sea is rough, and in calm weather the music of its church bells may be heard above the waters. The famous critic Renan, whose youth was spent in this region, says: "I often fancy that I have at the bottom of my heart a city of Is with its bells calling to prayer a recalcitrant congregation."<sup>12</sup> Who will say that this brilliant man's relation to Christianity would not have been the reverse of what it was, if the Christianity of Brittany had found the expression suited to the time? Was it not the outworn and lifeless form of it which, though it aroused no questionings in the simple life of Brittany, was found to be incompatible with the fuller light of his Paris experience? And was not the confounding of essence with form, of faith with intellectual assent to dogma, responsi-

<sup>12</sup> Renan, "Recollections of My Youth," Preface.

ble for the tension and pain of his first misgivings? On the one hand, he declares that Christianity is dead and nothing can be done for it until it is transformed.<sup>13</sup> On the other hand, he writes again to his friend the great chemist, writes from Rome, whose tranquillity and supernatural fascination had so completely changed him that he was no longer French and no longer the critic. "You know," says he, "that religious impressions are very potent with me and that as a result of my education they mingle in an undefinable proportion with the most mysterious instincts of my nature. These impressions have awakened here with an energy that I cannot describe to you."<sup>14</sup> When he says in the "Recollections," "I feel that in reality my existence is governed by a faith which I no longer possess," does he not really bear unconscious witness to the persistence of faith in spite of the vanishing of many beliefs? Dogmas fall into discredit before his critical faculty; but does he not retain his early sense of God and the eternal things? And those bells of Is ringing even in his last years in the depths of his being,—what are they but the echoes of the spiritual sphere still caught by the ear of a living faith through the clamors of the skeptical reason? the bond of

<sup>13</sup> "Letters from the Holy Land," 8.

<sup>14</sup> *Id.*, 34.

the unseen world, strained perhaps but still unbroken? I do not undertake to say how far one may go in the denial of intellectual propositions on religious subjects without losing the vision of God, which is the essence of faith.

Indeed, such a question is beside the present purpose. I advance no apologetic in behalf of these great names. They all, Hebrew, pagan, Christian, interest us in this connection only because they show how, in all religions alike, the advent of criticism precipitates the irrepressible conflict over the varied forms in which the religious principle expresses itself in life, and because they illustrate the different issues of that conflict in personal experience.

But the crisis passes. Out of the shadows the religious life emerges unruffled, deep; for it was only the outworks and appurtenances of religion that were involved in the struggle. Some of these it is better to surrender. When this distinction is recognized the tension has already begun to relax. As regards our own crisis, we may grant that the Gospel in its origin was connected with a view of the world which the progress of science makes impossible for us. The Gospel itself does not thereby become impossible for us. As says Harnack, its essential elements are timeless, and the man to whom it addresses itself is also timeless

in the sense that no progress which he makes ever changes his inmost constitution or his fundamental relations. "Since that is so, this Gospel remains in force, then, for us too." In its passage into the wider horizons of modern science, painful though it has been, the Gospel has given the latest demonstration of its inherent vitality and its permanent validity. It would be profitless to make an inventory of losses in the sphere of its accessories. It is too soon to be very sure what they are in all cases. What we need to observe is, rather, that Christianity has already dropped the antiquated view of the world and of history, and has found its place in the new world of science. The fact is attested by the highest science as well as by the latest Christian theologies. It is reflected in the poetry of the time. The minor Victorian poets are, indeed, smitten with the sense of disillusion. That "sea of faith once at the full," they

Only hear

Its melancholy, long, withdrawing roar.

Before the central mysteries of life and death, the poets of doubt, as Arnold and Clough, bemoan the failure of their quest and the retreat of the spiritual vision before the advance of science. The poets of art, as Swinburne and Rossetti, either deny the spiritual vision, or use its asso-

ciated sentiments for purely æsthetic purposes. These schools, however, only mark painful stages in the adaptive development of English poetry. Tennyson and Browning, the master-singers, carry forward that development to a higher point. They reflect the conflict of the period, but do not rest in it. Tennyson "marks the final stage of agnosticism feeling its way towards faith." And faith comes at last; peace follows the exhausting struggle; and, as he crosses the bar in the evening time, he is singing of meeting his Pilot face to face. In Browning the transition is completed. In him the hard-won calm assurance of Tennyson swells to the note of triumph, and when he passed out, he left this last word,— a personal record, it is true, but also the goal and crown of the Victorian quest of faith in the new world of science:

One who never turned his back, but marched breast forward,  
 Never doubted clouds would break,  
 Never dreamed tho' right were worsted, wrong would triumph,  
 Held we fall to rise, are baffled to fight better,  
 Sleep to wake.

### *Science in Religion*

I have given, as you see, a natural history account of religion, of its origin, elements, and development to its latest phase. Let us be on our guard against the subtle spread in our minds of the

feeling that such an account of religion empties it of divine content. For the discovery of a close-set evolutionary sequence sets aside neither the intelligent originating energy, nor the intelligent sustaining and guiding energy, which such a sequence presupposes. If God could enter the orderly succession of natural events only in a cloud, and stand to do His work only in places where we can put nothing else, we might question His having anything to do with a history which can be described from beginning to end in terms of cause and effect. But when we understand, as we do now, that He is already within all natural processes, that any sequence is a sequence because it is the expression of the unity of His purpose, then an evolutionary history such as we have sketched is seen to be alive with His presence from first to last. If we say that religion is psychological in origin, it is the same as if we say that God so made the human mind and so stationed it in the midst of relations that the thought of Him was natural to it. And if we say that man, in the course of his slow development out of savagery, has had such and such experiences with the thought of God, all that we mean is that man's enlarging capacity and widening outlook supplied the opportunity of a divine revelation of increasing clearness and fullness. God's education of man in the things of the eternal



world loses nothing of reality by suiting itself to the natural situation of the pupil and adopting the method which the divine operation takes everywhere else. Nor is such an education through natural evolutionary processes one whit less efficient than would have been a neatly graded series of religious text-books prepared in the skies and at the right intervals handed out to chosen teachers amidst fitting solemnities on the summits of sacred mountains.

For religion is a natural phenomenon; so natural and normal to the human constitution that, even from the biological point of view, it may be said to be diagnostic of man as compared with other organisms. It is of universal occurrence in the human species. Ethnology knows of tribes which cannot count beyond three, or five, or six, and which have neither dwelling nor trace of clothing, but it knows of none which is devoid of religion. The leading assertions to the contrary were made years ago by Herbert Spencer and Sir John Lubbock (now Lord Aveing), but Brinton, the chief authority on North American linguistics and religion, dismisses these assertions by saying curtly that neither one of the gentlemen ever saw a savage tribe. Religion is a more distinctive feature of man's nature than art, or music, or language, and the historic development of this

feature takes the same place and observes the same laws that anthropology recognizes in the case of every other fundamental human activity. Nor does religion in its highest phase — the religion of Jesus, even with its unique additions — fall out of this deep harmony with God's method in other sections of nature.

Furthermore, the religious consciousness itself, the moral and spiritual faculties, of which for convenience we may be still permitted to speak as distinct from other faculties, are themselves the highest product of evolution; they arise out of the bosom of universal nature. And they are still at home there. For religion, with which they have to do, is, like the conclusions of science, capable of a species of verification upon that understanding. The verification is both observational and experimental. There is the general observation that the evolutionary process culminates in a moral being whose further historical development in all other respects goes forward *pari passu* with this developing moral nature. Then, in the case of individuals, it is observed what strength the religious element brings into the personality, the capacity for achievement rising in proportion to the vividness of the religious consciousness. The practical mystic is invincible. Think of Paul, of Luther, of Cromwell, and the long line of the dreamers

“whose mastery over the temporal comes from their passionate devotion to the eternal.” As regards the experimental verification, Ruskin suggests that the only inquiry into the grounds of the Christian religion that is possible to simple and busy men,— and he intimates that it will be satisfactory,— is the practical trial for one year of the Sermon on the Mount in a genuine obedience of its teaching. Besides this sort of test another is available. In the case of human beings nature, by means of accident, or heredity, or disease, sometimes presents us with conditions which we are forbidden to produce. Nature thus occasionally produces a man who is incapable of apprehending the moral order and of responding to its demand. Such a man is observed to be abnormal in other respects and is foredoomed to defeat in life.

It appears, accordingly, that there is science in religion. Religion is grounded not only in the nature of man, but also in universal nature; and its rise and history, its elements and varied expressions in cult and creed are capable of being reduced to the orderly coherence and precision of science. It will not matter whether you call such a study and body of truth anthropology, or theology, or simply the science of religion. Only let me remind you that it is not religion, and can be no substitute for it in personal experience.

The sense of order and unity in all the departments of one's intellectual housekeeping may co-exist with dyspepsia and inanition of the housekeeper. The feeling of stability and rationalness is good for all our conceptions, including the religious, but it will not feed the soul. A writer tells us that on the coast of England at a certain point young gulls are fed for the market on curds and gravel, the former fattening them, the latter improving their digestion. They had besides, he adds, only a raw gust of the sea. The science of religion would resemble this regimen with the curds left out. It will meet an intellectual, but not a religious need. It has no ease for the burden of sin, no satisfaction for the longing after purity; it provides no fellowship for the orphaned spirit; opens no shelter and fountains of refreshment in the waste places of life.



**LECTURE IV**  
**RELIGION IN SCIENCE**

*The invisible things of him since the creation of the world are clearly seen, being perceived through the things that are made, even his everlasting power and divinity.*

— *Paul, Letter to the Romans.*

*It is true that a little Philosophy inclineth Mens Mindes to "Atheisme"; But depth in Philosophy bringeth Mens Mindes about to "Religion:" For while the Minde of Man looketh upon Second Causes scattered, it may sometimes rest in them, and goe no further: But when it beholdeth the chaine of them, Confederate and Linked together, it must needs flie to "Providence" and "Deitie."*

— *Bacon, Essays, "Of Atheisme."*

## RELIGION IN SCIENCE

**P**ROFESSOR HUXLEY, on the occasion of his receiving a public distinction, told a story of a member of the Society of Friends in the old pirate days. The lover of peace was a passenger on a ship which was threatened by a pirate ship. When the captain handed him a pike that he might take part in the common defense, he declined, though he was not unwilling to stand at the gangway and wait with the pike in his hand. When the pirates actually began to come on board, he pushed the sharp end of his pike into them, with the benevolent advice to each one, "Stay on thine own ship, friend."

In view of our last discussion and of that which is now proposed, the question may be asked, Are we not inviting trouble by mixing up the crews of two distinct and hostile ships? Does not reason say to faith, with the pike at her breast, "Stay on thine own ship, friend"? And is not faith equally concerned that reason stay on board its own ship? This question of distinct spheres has been heretofore touched upon incidentally. We must now consider it more directly.

As was remarked before, the view is widely



held. Dr. Osler, for example, told the medical students of Toronto University some eighteen months ago that they would all sooner or later come to the point where they would try "to mix the waters of science with the oil of faith." He said they could have a great deal of both, if they could only keep them separate; that the worry came from the attempt at mixture.<sup>1</sup> Dr. Brinton declares that religion and science arise in totally different tracts of the human mind, science from the conscious, religion from the sub- or unconscious intelligence, and that, therefore, there is no common measure between them.<sup>2</sup> We have noted, in the personal experience of a biologist and of a critic of our time, how these two powers of the mind presented themselves concretely in irreconcilable opposition, with different practical results. In the one case, a *modus vivendi* was established; in the other, faith with some protest, surrendered itself to the mastery of the rational faculty. The same antithesis appears in Tennyson:

If e'er when faith had fall'n asleep,  
I heard a voice "believe no more,"  
And heard an ever breaking shore  
That tumbled in the Godless deep;

<sup>1</sup> Johns Hopkins Univ. Circulars, Jan., 1904.

<sup>2</sup> "Relig. of Prim. Peoples," 331.

A warmth within the breast would melt  
The freezing reason's colder part,  
And like a man in wrath the heart  
Stood up and answered, "I have felt!"

No, like a child in doubt and fear:  
But that blind clamor made me wise;  
Then was I as a child that cries,  
But, crying, knows his father near.

This blind clamor of heart and head has served the useful purpose of bringing into clear relief the distinction between faith and belief, a distinction of great practical importance. Faith is seen to be of the essence of religion, belief concerns the form of it. Faith is the spirit's attitude of response to the unseen world, belief is the mind's assent to propositions about it. Faith, whose stages and processes escape logical manipulation, is said to be the gift of God; belief is a state of mind reached automatically in the presence of a body of evidence, and cannot, therefore, be enjoined as a duty. Consequently, faith does not have to wait for the settlement of the mind's perplexities, and the odium and the distress of religious doubt are not permitted to shadow the clearness of the heart's response to the divine appeal, which is the real test of the religious experience.

And yet, widespread and useful as the separa-

tion of the faith function and the rational function has been, I beg to remind you that faith and reason are powers of the same mind. Their strife is a civil strife. I am told that the old "faculty psychology," which treated mind as a sort of parliament of powers under the presidency of the will, is completely superseded. The mind is a unit and acts as a unit, when it acts at all. Moreover, reason is no more characteristic of mind than is will, which includes impulse, desire, and instinct, and is close akin to the operation which we name faith. Indeed, will is held by some psychologists to be the more characteristic action, intellect being the expression of will. If, now, we have learned thoroughly the lesson which Horace Bushnell taught nearly fifty years ago, and have ceased to set over against each other the natural and the supernatural as mutually exclusive; if we extend the natural to embrace the supernatural and enthrone God over all, so that as Dante has it, "that Emperor who reigns above rules in all parts," then the realm of nature becomes one to its farthest confines, and the same mental powers bring us into relation with all its provinces. The apprehending faculty we call reason when it works under the relations of time and space or elaborates the sense-given ideas of the material world. We call it faith when it deals with the timeless and

spaceless world, where the thought symbols that epitomize time and space experience are inapplicable, and where a certain vagueness of outline marks objects and events, probably because we have as yet no thought symbols for them except those derived from the still misty realm of our own consciousness. In mind functioning as faith, there occur, along with emotion, impulse, and desire, also cognitive elements, such as recognized traces of the divine movement in physical nature or history or personal experiences, traces as real as the footprints of long-vanished reptiles in the Connecticut Valley sandstone; and in the one case as in the other, with these materials of observation, the imagination sets about its proper work of reconstruction. Besides, there are the observations and reconstructions which countless generations back of us have made and which are now deeply organized in our constitution and rise up, we hardly know whence, to face us as imperious religious instincts. On the other hand, there is an intuitive or instinctive element in reason. While, as Pascal says, we *infer* the truth of propositions, we *feel* the truth of first principles. And who would deny the instinct of causality, of the existence of the external world, of the uniformity of natural law, which are presuppositions of the rational process everywhere?

It appears, therefore, that the opposition between religious intuition, or faith, and reflective analysis, or reason, is, as Edward Caird says, not a real opposition; each complements the other in the development of the religious life. This conclusion will, perhaps, prepare us to enter more hopefully upon the consideration of the positive religious affinities and implications of science.

### *The Spirit of Science*

I ask you to think first of the mental attitude of the masters of science, the spirit in which they have undertaken and prosecuted their work.

The publication in 1637 of Descartes' "Discourse on Method" is sometimes fixed upon as the beginning of the modern scientific development. In that famous treatise one of the central principles is the consecration of doubt as a duty; and the tradition of doubt, or skepticism, has clung tenaciously to the scientific calling down to our own day. But it is grossly misinterpreted. The apotheosis of doubt is supposed to be the chief feature of the cult of science, which offers sacrifice on no other altar. The case is far otherwise. The high-priest who, perhaps more than any other, is responsible for this apotheosis, declares that he always had an intense desire to learn how to distinguish truth from falsehood, in order to be clear

about his actions and to walk sure-footedly in this life. There is, he said, a path which leads to truth so surely that even the lowest capacity can find it; and this is his guiding rule by which a man may find and keep that path: "Give unqualified assent to no propositions but those the truth of which is so clear that they cannot be doubted."<sup>3</sup> Moreover, among the laws which he established for his own self-government occurs this fourth one: "Make the search for truth the business of life."

It is not doubt but truth to which Descartes pays homage, and the same high allegiance has bound all the priestly line downwards. Copernicus doubts the Ptolemaic astronomy until he can verify or displace it. Vesalius cannot bow at once before the authority of Galen and the authority of Nature. Lamarck, poor, old, blind, doubts the world which contemns him, that he may hold fast the new truth of transformationism, which is his sufficient consolation. Johannes Müller is led by doubt of the current teaching to a fresh examination of the foundations of physiology and morphology, and he gathers so large a harvest of truth that these sciences in his hands enter upon a new phase of development. Lyell doubts, and builds

<sup>3</sup> Quoted by Huxley, *Essays*, "Descartes' Discourse on Method."

the new geology. And so it has been with all those who have given a new pace or a new direction to our growing knowledge of nature. Doubt is the pathway, but truth is the goal.

Indeed, the leading characteristic of the scientific spirit is its whole-hearted consecration to truth, its openness of mind before every problem, its eagerness to press the solution to the last possible point of completeness, and the abiding peace with which it accepts the truth with all the consequences. And you observe that this distinctive attitude of the scientific mind clearly involves a moral quality and a capacity which is not unlike faith. I mean the capacity to see and bring near a lofty ideal and a nobleness of purpose in pursuit of it.

We are told that when Pasteur died a writer in one of the Paris newspapers "described the intimate routine of the life at the Pasteur Institute, and compared it with that of a mediæval religious community. A little body of men, forsaking the world and the things of the world, had gathered under the compulsion of a great idea. They had given up the rivalries and personal interests of ordinary men, and, sharing their goods and their work, they lived in austere devotion to science, finding no sacrifice of health or money, or of what men call pleasure, too great for the common ob-

ject. Rumors of war and peace, echoes of the turmoil of politics and religion, passed unheeded over their monastic seclusion; but if there came news of a strange disease in China or Peru, a scientific emissary was ready with his microscope and his tubes to serve as a missionary of the new knowledge and the new hope that Pasteur had brought to suffering humanity. The adventurous exploits and the patient vigils of this new Order have brought about a revolution in our knowledge of disease.”<sup>4</sup>

The brilliant research of the late surgeon Walter Reid upon the etiology of yellow fever also illustrates the method and the spirit of science. He goes into the smitten region determined to find the cause of the dreadful malady. When wholly negative results follow the bacteriological investigation, men volunteer to sleep in rooms where the garments and bedding of patients dead of the disease are hung and shaken. No one of the volunteers succeeds in contracting it in this way, and then they try sleeping in the garments and beds of yellow fever patients. This also failing, Reid bethinks him of mosquitoes, which had been shown able to transmit malaria. The men cheerfully submit themselves to the tremendous risk for the sake of others, allow

<sup>4</sup> Metchnikoff, "The Nature of Man," 111.



mosquitoes which had fed on the blood of patients to bite them, contract the disease, and demonstrate the agent of its spread.

These illustrations have already suggested that the scientific *dévotion* to truth is animated not simply by the joy of the quest, but also by the hope of some sort of ministry to human need. Physiology, the mother of sciences, developed early because the stimulus of such a ministry was always present and urgent. But even in the case where no issue of practical service is foreseen, the investigator is sustained by the conviction that truth is the most precious of all possessions for the shackles it will break and the light it will throw on the dark path of life. What is it that the aged Professor Huxley says? "If I am to be remembered at all, I should like to be remembered as one who did his best to help the people." On his admission to a seat in the French Academy, Berthelot, who revolutionized organic chemistry, said: "A *savant* worthy of the name consecrates a disinterested life to the grand work of our epoch: I mean the amelioration of the lot of all from the rich and happy to the humble, the poor, and the suffering. . . I have tried to make this the object and end, the directing purpose of my existence." Look on this picture of Louis Pasteur. He is leaning over the head of an enormous bull-

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dog whose eyes are blood-shot and whose body is convulsed with spasms. He is sucking up into a tube some drops of saliva at the distance of a finger's length from the foaming head. No saint's self-effacement under a lofty impulse surpasses that which this laboratory scene exhibits. No Brother Bernard's ardor of aspiration which kept his face upturned towards heaven for the space of fifteen years can be either intenser or nobler than this scientist's zeal and consecration to truth and humanity. While he was engrossed with the study of Splenic Fever and the experiments multiplied, Pasteur came to have what his daughter called the face of an approaching discovery. If any one timidly asked him what stage the investigation had reached, he would reply, "I can tell you nothing. I dare not express aloud what I hope." At last one day he came up from his laboratory with the face of triumph. Tears of joy were in his eyes. As he embraced the members of the family, he said, "I should never console myself, if such a discovery as my assistants and I have just made were not a French discovery."

### *The Faith of Science*

The scheme of physical nature is conceived to be something like this:—Gross matter consists of groups of atoms. Atoms consist of

groups of electrical monads. Electrical monads, or ions, are only knots in the ether. Electricity itself, the reality of which matter is the sensible expression, is a modification of the ether, the stuff out of which the universe is wholly made. Now, the intellectual satisfaction which such a simple and consistent view of things imparts is intense, almost æsthetic, as Mr. Balfour has remarked. Why is it so? Why should we be more pleased to think of the sum of things as one substance taking varied manifestations, than to think of it as composed of the seventy-odd elementary substances which are inherently different from one another? There is no answer but that we have our scientific prejudices, one of which is the prejudice in favor of simplicity of conception. Strange to say, this prejudice remains unshaken in the presence of evidence going to show the opposite character of the universe. We insist that the universe is simple and regular, in spite of apparent complexity and confusion. We are not content to observe and set down faithfully what nature actually presents to our senses; but we must needs work it over and bring it, with some violence it may be, into harmony with this deep-seated, ineradicable sentiment.

What we have here is obviously a sort of instinct about the nature of reality. However ob-

scure may be its origin, its intimations are definite and clear. It anticipates and interprets sense experience. It holds the torch for science to work by. In the language of philosophy it would be called the necessary postulate of science. I prefer to call it the faith of science. Science cannot explain its faith in the unity and regularity of nature, neither can it get on without it.

It will be useful to set the faith of science side by side with the faith of religion. This has been done, with a clearness and force which I cannot undertake to improve, by the late Professor Joseph Le Conte: "The necessary postulate of science, without which scientific activity would be impossible, is the rational order of the universe; and similarly the necessary postulate of religion, without which religious activity would be impossible, is the moral order of the universe. As science postulates the final triumph of reason, so religion must postulate the final triumph of righteousness. Science believes in the rational order, or in law, in spite of apparent confusion. . . . So also religion is right in her unmistakable belief in the moral order, in spite of apparent disorder and evil. . . . We may, if we like — as many do — reject the faith in the Infinite Goodness, and thereby paralyze our religious activity; but, then, to be consistent, we must also reject the faith in the Infinite Reason,

and thereby paralyze our scientific activity.”<sup>5</sup>

I may add that the faith of science is not without justification. Schiller says somewhere that Nature stands in an eternal alliance with Genius, and always honors its demands. For example, it is, according to Helmholtz, in the highest degree remarkable to see how large a number of comprehensive theorems, the proof of which taxes the highest powers of mathematical analysis, were found by Faraday without the use of a single mathematical formula, by a kind of intuition with instinctive certainty. And so, to the universal intuition of rationality and order, Nature responds with widening revelations of the supremacy of law. The progress of discovery is the practical justification of the scientific faith under which the progress was made. And we have noticed on a former occasion that when religious faith makes its venture upon the assumption of righteousness at the heart of things, it is not disappointed. The universe cashes its cheques in the currency of inward peace and a heightened efficiency for achievement in the outer life. The stars in their courses fight on its side for the supremacy of righteousness.

<sup>5</sup> Essay in Royce's "The Conception of God."

*The Bearing of Science*

In "Modern Painters" occurs a chapter "Of the Novelty of Landscape." A man acquainted with Greek, Roman, and Mediæval art is supposed to enter a room in which he sees for the first time a display of modern paintings. His first impression would be that there is something strange about the mind of these modern people. Mountains, lakes, trees, and bits of stone, clouds and runlets of water,—nobody ever seemed to be interested in these things before. The human interest, which wholly occupied the earlier painters, seems to have disappeared altogether. Not a picture of the gods or heroes, of saints or angels or demons, of councils or battles; but mountain peaks and ravines, forests and stretches of blue sky, stone walls, withered sticks, and flying frogs! Whether this extraordinary change of art subjects is one to excite pride or not, it is, as Ruskin says, assuredly one to excite our deepest interest. It is one of the expressions of the new sympathy with the phases of external nature which is one of the picturesque features of our period. This feeling occurs, indeed, in individual cases from early times in literary history, as in Horace and Lucretius and Theocritus, and in some of the early English poets; but to-day it is well-nigh uni-

versal, as is shown by the volume and popularity of out-door literature with its invitation —

Come forth into the light of things,  
Let Nature be your teacher.

This later phase of it may be traced back to the eighteenth century. There were in the realm of letters Rousseau and Cowper and Wordsworth, who were industrious propagators of the sentiment. There was the genial naturalism of Selborne, who taught Englishmen the inherent interest of common natural phenomena. Another representative of science was the Swiss geologist DeSaussure, who more than any other dissipated the ideas of horror and danger associated with mountains, and taught the world the infinite charm and variety of mountain scenery. In the latter half of the nineteenth century this sympathetic response to all nature's varying moods grew rapidly under the stimulus of the general scientific movement of the time and the influence of men like E. Krause in Germany, Richard Jefferies and Ruskin in England, and, on this side, "Old Silver-Top," as John Burroughs has been affectionately called, and his younger followers, as Roberts, W. J. Long, and Thompson-Seton.

Nature, which was once devoid of interest when she was not repulsive, is now invested with at-

tractions which are on every poet's tongue. We have acquired an eye for all her beauty, an ear for all her music, a heart open to all the suggestions of her solemn grandeur, her deep repose, her infinite order. She refreshes us in the inward part, she rebukes our strife and pettiness, she elicits and confirms our aspirations. We no longer have to make our way through an enemy's country at the risk of losing our religion at every step. The later and deeper scientific interpretation of Nature makes her our ally and friend. One is not surprised, therefore, to hear Professor Shaler saying that it was a more profound grasp of science itself that brought him back from an early excursion into religious negations.<sup>6</sup> For science has now laid bare the solid foundations on which religion reposes. Let us take note of some particulars.

1. *The Unity of Nature.* I have a mathematical friend who says that mathematics, as well as the Bible, makes the proclamation, "Hear, O Israel, the Lord thy God is one God." He explains that the number of curves of the fourth power of the unknown quantity is countless, and those of the fifth power are even more numerous; and yet he shows me an expression containing a very few letters that will apply to the length of

<sup>6</sup> "The Interpretation of Nature," iv.



every possible curve, another that will apply to the surface described by the revolution of every possible curve, and another to the solid described by the revolution of every possible curve. In short, for this infinite diversity, one comprehending principle.

We are able to-day to recognize relations where formerly only discrete facts were perceived. We discover interdependence and harmony where to the older conception there appeared only isolation, if not discord. For us the doctrine of the ether and the law of gravitation bind the myriad worlds of space into a consistent universe. The law of evolution unifies the totality of nature as it exists to-day by supplying the one method of its origin, as the protoplasm theory imparts structural unity to the varied forms of organic nature. The law of the correlation of energy obliterates the territorial boundaries which formerly divided off the phenomena of nature into distinct and unrelated regions. It might have been foreseen that, after the unity of external nature was discovered, the moral and spiritual sphere could not long withhold the secret of its inner consistency and relationships. Here also boundaries have taken themselves up and off, and the separate and warring provinces of the spirit have fused into one realm under one law. So that the natural and the

supernatural no longer threaten and confound one another across an impassable chasm. There is no chasm. The supernatural is natural, and the natural is supernatural. Even that inveterate antithesis of matter and spirit shows signs of dissolving. In some of the seers of the race, as Plato and Dante, matter and spirit compound for their differences and almost melt into one another; in the impassioned glow of their conceptions, as Walter Pater points out, the spiritual attains visibility and the material drops its earthiness. But with a new stress and inflection we are now asking whether matter is not simply the signal of the spirit's activity, the theatre where the spirit disports itself, the word in which the spirit seeks expression, the garment of beauty in which the spirit arrays itself.

Moreover, the divine and the human nature draw into a close fellowship, the human nature being divine in its origin and aspiration, and the divine nature finding that it can express itself in the human. The divine nature no longer sits apart in remote cold clouds concerning itself with man only to impose an arbitrary legislation from which it is itself exempt. On the contrary, with the new light on that ancient word "Let us make man in our image," we now see that community of nature necessitates one law. There is not one righteous-

ness below and another above the clouds. The coinage of the moral realm must pass current in heaven and on earth alike.

Lotze remarks that, "to us who admire the isolated remains, the thought expressed in many an ancient work of art seems to be too slight in comparison with the labor expended in presenting it in sculpture; but such works were then intended to serve as fitting adornments in edifices the most insignificant details of which were pervaded by a coherent idea of harmonious beauty of form." So, isolated and apparently insignificant details of nature acquire meaning and become worthy and noble in the light of their relation to the majestic structure of which they are constituent parts. But this consideration is not all. The unified system of things revealed by science is the necessary corollary of the religious faith in the infinite personal Intelligence. If God exists, this is precisely such a world as He would make. There can hardly be any doubt that the growing conception of the unity of nature which has marked the last three or four decades had much to do with the unmistakable movement towards faith during the same period.

2. *The New Teleology.* But one may say that nature may be a self-consistent unit, and yet be nothing more than a machine, and therefore

morally indifferent; or, if it have moral significance, what assurance have we that it is good and not bad? Indeed, one meets such views now and again in contemporary literature. For example, in his well-known lecture on "Art and Morality," Ferdinand Brunetiere declares that nature's indifference to us is equalled only by her lack of regard for all that we call by the name of good or bad. He goes still further and says, "Nature is immoral, thoroughly immoral; . . . there is no vice of which she does not give us an example, nor any virtue from which she does not dissuade us"; and in her failures, exceptions, and monstrosities he thinks he finds evidence that she is no more true than she is good.

There can be no surprise that laymen in science take such a view when it is remembered that scientists themselves have given the cue. So acute and influential a man as Professor Huxley was not a little perplexed by what he considered the conflict between the cosmic process and the ethical process which is observed in human history. In his famous Romanes Lecture on "Evolution and Ethics" in 1893, he said: "The practice which is ethically best — what we call goodness or virtue — involves a course of conduct which, in all respects, is opposed to what leads to success in the cosmic struggle for existence. In the place of

ruthless self-assertion it demands self-restraint. . . . It repudiates the gladiatorial theory of existence." He thinks, furthermore, that, since both have been evolved, there is as much natural sanction for the immoral sentiments as for the moral. Accordingly, it seems, on the face of things, that the ancient philosophy of pessimism gains in the evolution theory a new and broader basis; the doctrine that Satan is the Prince of this world gets a scientific foundation. The struggle for existence is as cruel as it is inevitable. The tyranny of strength and cunning is unmitigated. Teeth and claws go at their bloody business without mercy. And all life together is helpless under the mighty hand of fate, which seems supreme in the physical world. Vain is the cry of the innumerable tender things which are crushed in the grind of the great machine.

But we need to take a second and deeper look at the ethical bearing of the evolution theory, to see whether this dark and bloody inference is justified. The trouble with the inference lies in the limited range of the induction, in the lack of perspective. Its observation is too exclusively microscopic. One day when this matter was in discussion Tennyson told the story of a tender-hearted Brahmin who, on observing with the microscope how the creatures in the world of a

water-drop were devouring one another, was moved with a boundless indignation at an instrument which made such a revelation of heartless cruelty, and smashed it into fragments. What we require is, not to make this sort of observation impossible, but to supplement the microscope with the telescope, to lift our eyes from details to tendencies, from the individual to the species. I think we shall see that "the gladiatorial theory of existence" is unwarranted.

Let me remind you that the terms in which it is expressed — self-assertion, struggle, the hunting down of competitors — are figures of speech in scientific literature, and when they are interpreted in strict literalness are wholly inapplicable. We are not justified in reading human standards and sentiments into the behavior of the lower animals. The butcher-bird which rends a titmouse limb from limb is no more cruel than the human butcher who quarters beef for the market; nay, than that same Texas steer was when his lithe tongue lapped in the helpless tender herbage of the prairie. If a man should rend a titmouse limb from limb, the action would be properly called cruel; but the butcher-bird is not a man, and its action is neither good nor bad, for it is not performed in the realm of moral ideas. It is true the bird is not merciful; neither is it moved

by malice. Besides, it is not improbable that the exposure of the titmouse tribe to such a peril reacts favorably upon the tribal constitution, improving in the long run its powers of flight and its wits. If so, whatever view the impaled individual titmouse may take, the butcher-bird is the friend of the species, a blessing in disguise. And it is to be remembered, further, that the birds of prey are not to be compared in the number either of species or of individuals with the vegetable feeders. There is, in fact, no adequate ground for the popular view which, under the theory of the struggle for existence, construes the world as an arena where all organisms, man included, fight one another to the death. When species are exterminated at all, it is not in a wholesale slaughter, but by the gradual and usually painless operation of forces extending over a succession of generations, such as the failure of correspondence with the total environment, which may or may not include animals of prey. A most effective factor and one which involves no suffering is the progressive diminution of the degree of fertility necessary to the maintenance of the species. Another is the weakness or rigidity of organization which retards unduly its adaptation to a changing environment.

With this explanation of terms, we may ad-

vance to consider the general trend of things under the evolution process. Now, it is involved in the nature of the process that "the first in conception is the last in execution"; a tendency is to be judged by its issue. The last term of an evolutionary series may prophesy what is yet to follow, but it can hardly be doubted that it also interprets what has gone before. The nature of man is the crown of the process of evolution. We need not inquire now whether a still higher creature is possible to it. We only need to recognize man as the latest and highest term in a long series which stretches back to the dawn of organic life on earth. His physical frame is the most complex in structure and the most efficient in action in the whole series. His mental life is the widest, the fullest, and the most varied. His moral nature is so much advanced beyond what appears in any of the creatures below him that some deny its hereditary connection with any possible germs of morality anywhere else in the series. This highly endowed creature whose most distinctive feature is his capacity to discern the good and the bad, standing thus as the climax of the natural achievement, throws backward over all the lower grades of organization a light in which the meaning and purpose of all grow plain. In this light Nature is seen to be on the move. Things are marching



out of a dim past into a widening future. The struggle for existence is transformed into "a race for perfection." The cosmic process is itself driving forward to an ethical issue, and that once reached the development is continued into religion and social regulations. And how can the cosmic process be in conflict with the ethical process which, even according to Professor Huxley, was produced by it? Will the mother repudiate her offspring?

In this general purposive progress from the inorganic to the organic, from sensation to mind, from mind to morals and religion,—from the clod to conscience,—we have ample compensation for the surrender, upon the demand of science, of Paley's minute design, the teleology of details. Shall I appeal to the authority of Darwin? He cannot, indeed, allow that the variations of organic beings are designed, but he says, "If we consider the whole universe, the mind refuses to look at it as the outcome of chance, i.e., without design or purpose."<sup>7</sup> And here is Huxley saying that "it is only the common and coarser forms of teleology that fail when tested by natural selection. There is a wider teleology which is not touched by the doctrine of evolution, but is actually based upon the fundamental proposition of

<sup>7</sup> "More Letters," I, 395.

evolution.”

The end and explanation, the climax and denouement of the divine drama in creation, is the emergence from the bosom of universal nature of a spirit which can stand erect and speak face to face with God. And God is repaid for æons of waiting and travail, for it breaks His infinite solitude, His unaccompanied journeyings through wildernesses of insensate things, and presents Him with a person, in some way his counterpart, in possibility His friend. The rise through successive grades of being up to this fulfilment of the creative impulse is symbolized in epitome in Seraphita's farewell on the eve of her translation when she looks out over the mountain-girt fiord from the cliff of the Sieg: “Farewell, rock of granite, thou shalt be a flower: farewell flower, thou shalt be a dove: farewell dove, thou shalt be a woman; farewell woman, thou shalt be Suffering; farewell man, thou shalt be Belief; farewell, you, who shall be all love and prayer!”

3. *The Idealistic Interpretation of Nature.*—The illuminating and supporting influence of science upon religion is not restricted to the two generalizations which we have now considered. There is another of perhaps even richer significance to which, as I conclude these lectures, I must call your attention.

Within the last thirty or forty years there has been in progress a marked change of feeling on the part of leading men of science respecting the ultimate reality, the deeper meaning of the universe; so that to-day scientific opinion presents a radically different front on this paramount question. About the middle decades of the last century it seems to have been flushed with its recent conquests and to have been in high conceit with its well-nigh omnipotent method. It was already well advanced in its mission of plucking the heart of mystery out of universal nature, and but a few years more of the unflinching application of the laws of physics and chemistry would suffice to finish the business and set man free from the thralldom of the last superstition. It was dogmatic and arrogant. Latterly, however, scientists have recognized with increasing clearness that they have been occupied with surface problems whose solution has merely led them in to the central mysteries, and before these they stand in a helpless impotence which has completely changed their tone and attitude. The physical tests on which they have hitherto relied cannot be applied here, and the impression is produced that the essence of things, which refuses to respond to these tests, is after all not physical. Haeckel himself cites a number of cases of such changes of view, such

psychological metamorphoses, as he calls them,—Virchow, Emil du Bois-Reymond, Wundt, Von Baer. He seeks to explain them as due to the increase of prejudice and the loss of energy attendant upon the decay of the brain as old age comes on. He must have forgotten this “explanation” when he came to write his preface, in which he says: “For fully half a century has my mind’s work proceeded, and I now, in my sixty-sixth year, may claim that it is mature”!<sup>8</sup> In reality these changes spring out of the fuller recognition of the limitations of the scientific method, the ease with which the assurance of a predetermined negation may be broken down. With Browning’s acute old Bishop, these scientists say:

How can we guard our unbelief,  
 Make it bear fruit to us? — the problem here.  
 Just when we are safest, there’s a sunset-touch,  
 A fancy from a flower-bell, some one’s death,  
 A chorus-ending from Euripides,—  
 And that’s enough for fifty hopes and fears,  
 As old and new at once as Nature’s self,  
 To rap and knock and enter in our soul,  
 Take hands and dance there a fantastic ring,  
 Round the ancient idol, on its base again —  
 The grand Perhaps. We look on helplessly;  
 There the old misgivings, crooked questions, are.

Science is much more modest than formerly in

<sup>8</sup> “The Riddle of the Universe,” Preface, vii.

the presence of the universal religious instinct.

Not only so. There are positive declarations on every hand that the conception of the physical world as a mechanism constructed on a rigid mathematical plan "has no more objective reality than the circles of latitude and longitude on the sun." Hear this word of Professor Karl Pearson: "Step by step men of science are coming to recognize that mechanism is not at the bottom of phenomena." And this from the President of the British Association last year: "As natural science grows it leans more, not less, upon an idealistic interpretation of the universe." Indeed, all men, excepting of course always the eminent zoologist of Jena, all men are feeling now that a system of things out of which by natural processes mind arose must itself be mental. And there seems to be no longer any reason to question Sir Oiver Lodge's recent statement,—“the region of religion and the region of the completer science are one.”

I think of Science as passing to and fro in God's garden, busy with its forms of beauty, its fruits and flowers, its creeping thing, its beast and bird, the crystal shut in its stones, the gold grains of its sands, and coming now at length in the cool of the long day upon God Himself walking in His garden.

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